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A PRACTICAL TREATISE

ON

Materia Medica and Therapeutics

WITH ESPECIAL REFERENCE TO THE CLINICAL APPLICATION OF DRUGS

BY

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SEVENTH EDITION. REVISED.

PHILADELPHIA

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TO

THE MANY PUPILS

WHO HAVE ATTENDED HIS LECTURES DURING THE PAST THIRTY-ONE YEARS AND ARE NOW PURSUING THEIR PROFESSION IN THE UNITED STATES OF AMERICA AND IN MANY FOREIGN COUNTRIES

THIS VOLUME,

ILLUSTRATING AN ALL-IMPORTANT AND PRACTICAL DEPARTMENT OF MEDICINE, PHARMACY, AND DENTISTRY,

IS

RESPECTFULLY INSCRIBED BY THEIR TEACHER,

THE AUTHOR.

PREFACE TO THE SEVENTH EDITION.

The demand for a seventh edition of this work within such a short period as that which has elapsed since the last one was issued, is extremely gratifying to the author, and assures him that it has been measurably successful in meeting the demands of the two classes—the active general practitioner, and the overworked medical student—which he originally designed it to serve. The thanks of the author are due and are hereby tendered to the Medical Press, which has from the beginning recognized the practical character of the work and has repeatedly reviewed it in the most favorable terms. In the last edition the text was made to conform with the recent revisions of the United States and the British Pharmacopœias, and the opportunity was seized at that time of thoroughly revising the book, and of adding many new titles, with other new features. As the time has been so short since the last edition of this work it was not found practicable to make many additions in the present, although some minor changes have been introduced.

It would not be possible, without very materially enlarging the present work and proportionately defeating its original object and its usefulness as a convenient text-book and handy work of reference, to take up, for discussion, all of the methods of treatment which occupy so much space in the medical journals of the day, but which cannot be considered as having had their value, as yet, finally and definitely established. For instance, the opsonic method of Wright and Douglass, which is so attractive from the laboratory point of view, has, in my estimation, yielded so little clinical fruit, that I have not felt warranted in according it full recognition as a justifiable therapeutic resource.

J. V. S.

PREFACE TO THE SIXTH EDITION.

The coincidence afforded by the exhaustion of a very large edition of this work, and the publication of a new revision of the United States Pharmacopœia, has afforded the author an opportunity of making many additions to the text, which he believes will make it fairly, if not fully, representative of the present state of therapeutics. The numerous pharmacopœial alterations in nomenclature and in the strength of official preparations, and also the many new titles which have been added, have necessitated a thorough revision of every page, particularly in order to make the second part correspond with the present standards, both of the United States Pharmacopœia and the British Pharmacopœia. Among the notable changes from the last edition are the following: Part I is entirely added, having been taken from the limited Students' Edition, thoroughly revised, and completed by adding a comparative table, giving the changes in the strength of preparations and relative dosage, in the present Pharmacopœia and the one which preceded it. Among the new therapeutic agents will be observed a consideration of the Roentgen-Ray and the Finsen Light, or Actinotherapy, Serumtherapy, Animal Extracts, Vibrotherapy, Hydrotherapy, etc., etc. Every part has been carefully revised, and, when possible, condensed, so that, notwithstanding the large addition of new material, the work has been really increased only by about one hundred pages altogether. The features of the work which have met with approval by readers, have been retained. In preparing the present edition, the author has kept in view, as heretofore, the needs of the medical student, as well as the physician, and he hopes that it will be found no less useful to those who consult it than the former editions which it supersedes. He will be very much gratified, if it will be deemed, at least in some measure, contributory to the progress of scientific medicine, and the establishment of rational therapeutics in this country.

J. V. S.

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PART I.

GENERAL CONSIDERATIONS CONCERNING REMEDIES AND SYSTEMS OF THERAPEUTICS.

THERAPEUTICS, or the treatment of disease, makes frequent use of certain agents, which are known collectively as **remedies.** In point of fact, every preventive, reparative, or restorative means which is, or can be made, available for the relief of the sick is a remedium, or remedial agent, in a comprehensive sense of the term. It follows from this that remedies are of many kinds and of varying importance; indeed, they are almost as numerous and diverse as the causes of disease themselves. The principal **classes of remedies,** however, are comparatively few, and these may now be taken up systematically for consideration. A very important class is composed of remedial measures which seek to prevent disease, or, if it be already present, to shield the patient from the effects of unsanitary influences and thus place him under more favorable conditions for recovery than those under which the sickness originated; such are known as **prophylactic,** or **hygienic, remedies.** They presuppose, on the part of the medical attendant, an acquaintance with the physiological laws of the human body, and of the effects of food, clothing, climate, occupation, habits, etc., upon its functions, and the skill to apply this knowledge to the individual case. Among prominent hygienic remedies are dieting, bathing, ventilation, change of residence or of occupation, due regulation of habits, and especially regulated exercises, including gymnastics and massage. These are **sanitary, prophylactic,** or **hygienic, agents** when employed to preserve health and prevent disease; they become **sanatory,** or **curative, measures** when utilized in conjunction with appropriate medical remedies, as they constantly are, in the treatment of the sick. In the latter case they are also included under the comprehensive term **regimen.** It is now considered of as great, or even greater, importance to regulate properly the ventilation and temperature of the sick-room, to direct the bathing and food of the patient, and to decide whether he shall have rest or exercise, in most instances, than it is to frame a prescription nicely adjusted to the state of the case, although the latter is by no means to be slighted. Light, heat and cold, magnetism, and electricity are also capable of powerfully influencing the bodily functions, and, when wisely directed, may produce positive sanatory, or curative, effects. These **imponderable remedies,** or **forces,** as they have been called, are receiving much attention at the present day. As a result of the profound and painstaking investigations of many scientists and the careful observations of expert clinicians, the medical practitioner is now, indeed, for the first time, in a position to satisfactorily apply these remedial agents and to record the results of his studies in exact and scientific terms. **Mechanical remedies** include various surgical measures, such as acupressure, acupuncture, aspiration, bandaging, blood-letting, etc.; also the various forms of gymnastics known under the name of Swedish movements, the move-

ment cure, passive motion, etc. Last, but by no means the least important, among remedies which, at least, are partly mechanical, is **massage**, to which attention has been already called as a hygienic agent, and to which due consideration will be given hereafter in a special section, under **Kinesitherapy.** Finally, there is a class of remedies which are considered of such importance, and are so commonly used in the treatment of every condition of disease, that they are popularly termed "medicines"; these properly are **drugs,** or **pharmaceutical remedies.** Formerly they were divided into chemical agents and drugs proper, or Galenicals; but this distinction has lost its force, since it has been shown that herbs, or "simples," owe their medicinal effects to "active principles," which are chemical in their nature, and which may be isolated and administered separately in order to produce the characteristic physiological and therapeutical effects of the drugs.

Therapeutics (Θεραπεια, treatment) considers the application of remedial agents to the treatment of disease, and the proper care of the sick. Other medical studies are only the foundation, therapeutics is the superstructure. As Fothergill has well said, "the ultimate aim of all medical research is the treatment and prevention of disease." For convenience, it is divided into surgical and medical therapeutics. Many systems of therapeutics have been formulated in times before the present application of exact scientific methods to the study of the action of drugs and the investigation of pathological and clinical problems, and so-called "schools of medical practice" have been founded thereon, which have now become obsolete and almost forgotten. Having at length a sound foundation of accumulated knowledge and experience upon which to rest our practice, we are, at the present day, prepared to base a system of **rational therapeutics** upon the demonstrated and established effects of drugs in healthy and diseased conditions, and upon our knowledge of the nature and course of morbid processes in the human body. The only scientific system possible is one which (1) endeavors to remove morbific causes, or render them inoperative; (2) seeks to repair the ravages of disease, or to correct abnormal physiological action; (3) aims to ameliorate the condition of the patient by relieving prominent symptoms, such as pain, fever, sleeplessness, loss of appetite, etc., and (4) places him under conditions most favorable to recovery. **Symptomatic treatment,** which seeks merely to remove symptoms, without investigating their causes, is obviously unsatisfactory and unscientific, but occasionally is resorted to in an emergency when such symptoms are urgent. **Empirical treatment** was the only kind of treatment possible before the mode of action and the effects of medicines were understood; it merely directed that certain medicines should be taken for the reason that in apparently similar conditions their administration had been followed by good results. Owing to the fallacious character of the teachings of experience, as pointed out by Hippocrates in his celebrated aphorism, it results that pure, blind empiricism abounds in fallacy, and, as a rule of practice, is the poorest system of treatment to follow. Where the knowledge obtained at the bedside, however, is aided by sufficient acquaintance with the physiological action of drugs, already referred to, we have modern "Rational Medicine," which affords to the patient all the assistance which science and experience combined can provide toward hastening and completing his recovery. It is an enlightened empiricism, which is not based on fixed law, but is progressively improving in proportion with advances in other departments of science. Any practice

of medicine assuming to rest upon a foundation less broad than this, or on a system which is fixed and stationary, by its own terms separates itself from scientific medicine, and makes its followers a medical sect, or "school." In the course of centuries many such schools have been brought to light, and, after a brief period, have been outgrown and forgotten. Such a fate is the natural destiny of any restricted system, based upon dogma. The system of medicine which is studied as a department of natural science, and which is unrestricted by any hypothesis, or supposed law of cure, in its application of remedies to the treatment of disease, will undoubtedly vary somewhat in its results, according to the individual skill of its practitioners, the scientific attainments of the time, and the peculiarities of patients; but when statistics are correctly compiled from sufficiently large groups of cases it must be more successful than any restricted system which has been or can ever be brought in competition with it. In order to avoid misapprehension, it may be proper at the outset to explain that in the present treatise this system of scientific, or so-called "regular," medicine, will be followed. Scientific, or regular, medicine is quite distinct from any school or sect in medicine, and is equally separate from so-called "allopathy" or "allopathic practice." As every educated physician knows, there is a radical difference between "an allopathic doctor" and "a regular practitioner," inasmuch as one is sectarian and the other non-sectarian. In point of fact, at the present day there are no allopathic physicians and, of course, no "allopathic" examining boards, and all followers of scientific medicine should resent the application of such a sectarian title to designate the regular practice of medicine.

At the same time that we discard restrictions as to therapeutics and claim the right to employ whatever remedial means experiment and observation lead us to believe will benefit our patients, it should not be forgotten that the knowledge at our command is derived from various sources, and if we are willing to acknowledge the indebtedness of modern medicine even to native tribes for many useful remedies, we should not be above admitting the fact that useful lessons may also be occasionally learned from followers of exclusive schools of medicine, or so-called irregular physicians. "Every judicious physician," said Dunglison, "must be an eclectic," in the sense that he selects from every source the best means of controlling disease. In the ordinary restricted sense, an eclectic is one who confines himself to vegetable drugs, or, in other words, is a botanic physician, and in this sense it has been appropriated by a sect of physicians who were formerly known as Thomsonians, from the name of the founder. In the ranks of regular medicine, also, there are specialists in therapeutics, some confining their practice to massage or gymnastics, others to electricity, others again to bathing, or hydropathy. The qualified physician or general practitioner appreciates the value of all the various agencies that are used in treating the sick, and assigns to each its proper place in his therapeutics, directing his treatment not against disease, but to the improvement of the health of patients who are, for the time, in a diseased, or abnormal, condition.

A complete cyclopædia of therapeutic agents should include in its consideration every remedial measure which the best educated and most skillful physicians employ in treating the sick, giving to each its proper place and value. As there are separate treatises upon hygiene, dietetics, massage, balneology, and electrotherapeutics, and the importance of these subjects warrants their separate treatment, modern text-books of therapeutics are

usually restricted to treatment solely by pharmaceutical remedies, or drugs. Nevertheless, the author has given due consideration to the other forms of remedial agencies, such as electrotherapeutics, hydrotherapeutics, kinesitherapy, metallotherapy, balneology, climatology, and hypnotism, all of which, in the third part of this work, will be found under their proper titles.

PHARMACOLOGY AND THE PHARMACOPŒIA.

Pharmacology (*φαρμακον*, a medicament; and *λογος*, a treatise) is, broadly speaking, the science of drugs. One of its branches is **Pharmacognosy**, or the study of their natural history, their physical and chemical characters, tests for purity, etc. Another is **Pharmacy**, which comprises the various methods of compounding and dispensing drugs in their several combinations for the treatment of disease. The place where medicines are dispensed is also called a pharmacy. Some authors have restricted the term "pharmacology" to the results obtained from the study of the physiological action of drugs, but this is more appropriately named **Pharmacodynamics.**

The **Materia Medica**, or collection of pharmacological remedies, may be divided into crude drugs and preparations. The latter may be made according to established formulæ, both official and non-official, or they may be extemporaneously compounded, and dispensed, according to the directions furnished by a physician. The latter are known as "magistral" preparations; they are compounded according to the formula contained in the **prescription**, of which more will be said presently. Official remedies are those recognized by the Pharmacopœia. The formulæ and directions for compounding "official" preparations are established by the authority of the pharmacopœia. Since this authority does not extend beyond the geographical limits of the country to which it belongs, it follows that England, France, Germany, Sweden, and other countries, as well as the United States, have pharmacopœias of their own. Remedies belonging to each are distinguished by initials indicating their source; thus U. S. P. means United States Pharmacopœia; B. P., British Pharmacopœia; F. P., French Pharmacopœia, or Codex Medicamentarius; G. P., German Pharmacopœia; S. P., Swedish Pharmacopœia. In the usual and modern acceptation of the term, a **pharmacopœia** is a medical book, issued by authority, containing a list of recognized drugs, with descriptions and physical characters, tests for purity and medicinal activity, and formulæ for accepted preparations. The necessity of having some standard to define the character, establish the purity, and regulate the strength of medicinal preparations is universally conceded. Those countries which do not possess a pharmacopœia of their own usually adopt the French Codex, or the British, or the United States Pharmacopœia. Unfortunately, it may happen that a preparation will have the same title, but differ considerably in strength in different pharmacopœias, such as the tincture of belladonna-leaves and especially the extract of aconite, which is a source of error in copying formulæ from English, French, or German sources, since some preparations in the United States Pharmacopœia are considerably stronger than the corresponding foreign preparations.

The **Pharmacopœia of the United States** is not issued directly by authority of the government, as in other countries, although it is adopted in the medical departments of the army, navy, and marine-hospital service, and it has been recognized as the final authority upon the purity and preparation of medicinal agents in recent Acts of Congress. It is compiled as a purely voluntary undertaking by the physicians and pharmacists, in accordance with the following arrangement: Every ten years representatives from medical societies and colleges, pharmaceutical societies and colleges, and delegates from the Army, Navy, and United States Marine-Hospital Service, meet in Washington, forming the National Convention for the Revision of the Pharmacopœia. After organization and the disposal of business, which may come before it, a standing committee on revision is appointed, which, having received instructions from the convention, proceeds to prepare and publish an edition of the United States Pharmacopœia. The first issue was in 1820, and the eighth revision was that of 1905. This went into effect September 1st of that year and has displaced the former editions. Important changes have been made in the strength of some preparations, and a number of new titles have been introduced. It is incumbent upon both physicians and pharmacists to follow the present Pharmacopœia in prescribing and dispensing drugs, especially in those States in which it has been adopted as the legal standard. Many new remedies had been brought to the notice of the profession since the previous revision, some of which have come extensively into use and possess decided merit, others are ephemeral and will soon sink into well-deserved neglect. Owing to the present degree of activity in therapeutics, it is impossible that the pharmacopœia should include all the medicinal agents used by physicians in the treatment of disease, especially those more recently introduced. Therefore, a considerable number of **unofficial drugs** are in use, some of which will eventually prove their right to be recognized and become official, while many others will never be able to make good their claim. Proprietary remedies, or preparations made by secret formulæ, are sold very largely to the public, and are sometimes prescribed by physicians, who appear to be unmindful of the fact that the Code of Ethics denounces this as a reprehensible practice. The prescribing of preparations of unknown composition is opposed to the best interests both of scientific medicine and of the public.

MATERIA MEDICA.

The **Materia Medica** consists of official and non-official drugs and their preparations. It has several branches. Pharmacognosy investigates the physical characters of drugs in order to establish their identity. Medical botany establishes their place in the vegetable kingdom and their botanical grouping or relationship. Plant-chemistry determines the constituents of the drug and isolates the so-called active principles; it also teaches the chemical antidotes. In the United States Pharmacopœia all remedies are arranged under their Latin titles alphabetically, and, owing to its convenience, the same plan has been adopted in the present work. A large number of unofficial, or extra-pharmacopœial, drugs are also considered. It is possible to adopt also a natural method of classification of drugs or an

artificial arrangement into classes according to the physiological or therapeutical effects. A scheme of the latter kind appears at the conclusion of this section. The following list comprises most of the drugs in use, arranged according to their natural affinities and chemical characters:—

Inorganic Materia Medica.

Group I.—*Non-metals.*

Hydrogen.
Oxygen (ozone, hydrogen dioxide).
Sulphur (hydrogen sulphide).
Carbon (charcoal).
Bromine (hydrobromic acid).
Chlorine (chlorinated lime or chlorinated soda).
Iodine (hydriodic acid, the iodides, etc.).
Nitrogen (nitric acid, etc.).
Phosphorus (phosphoric acid).

Group II.—*Metals (a) of the Alkalies and Alkaline Earths.*

Monad Metals.—Potassium, Sodium, Lithium, Ammonium.
Dyad Metals.—Calcium, Strontium, Barium, Aluminum, Magnesium, Zinc, Copper, Cadmium, Silver, Mercury.

(b) The Heavy Metals.

Triad Metals.—Thallium, Iridium, Gallium.
Tetrad Metals.—Lead, Tin.
Pentad Metals.—Phosphorus, Arsenic, Bismuth, Antimony.
Hexad Metals.—Chromium, Tungsten, Molybdenum.
Heptad Metals.—Manganese.
Unclassified Metals.—Iron, Nickel, Cobalt, Platinum, Gold, Radium.

Organic Materia Medica.

Group I.—*Carbon Compounds.*

(a) ALIPHATIC, OR FATTY SERIES.

Hydrocarbons.
Benzinum.
Petrolatum.
Acetone.
Alcohol (ethylic, methylic, amylic).
Aldehydes (ethylaldehyde, paraldehyde, and formaldehyde).
Ether.
Ethereal oil.
Ethyl-chloride.
Amyl nitrite.
Acetic ether.
Glycerylis nitras.
Ethyl-bromide and iodide.
Chloral-hydrate.
Bromal-hydrate.
Ethyl carbamate.
Methylis salicylas.
Chloroform.
Chloralformamidum.
Iodoform.
Iodol.
Sulphonmethanum.
Hexamethylenamina.
Sulphonethylmethanum.

(b) AROMATIC SERIES.

Carbolic acid, or Phenol.
Creosotum.
Guaiacol.
Resorcinol.
Methylthioninæ hydrochloridum.
Pyrocatechin.
Salicylic acid.
Naphthalenum.
Betanaphthol.
Chinolin.
Kairin.
Antipyrina (phenazonum).
Phenylis salicylas.
Acetanilidum.
Acetphenetidinum.
Benzol.
Cresol.
Toluol.
Benzoic acid.
Pyridina.

Group II.—*Vegetable Materia Medica.*

SUBKINGDOM I.—PHANEROGAMÆ.

CLASS I.—EXOGENS.

DIVISION I.—ANGIOSPERMÆ.

SUBCLASS I.—THALAMIFLORÆ.

Natural Order.	*Name.*	*Synonym.*
Ranunculaceæ.	Ranunculus,	Crow-foot, buttercup.
	Aconitum,	Monk's-hood.

Natural Order.		*Name.*	*Synonym.*
Ranunculaceæ (*continued*).		Staphisagria,	Stavesacre.
		Delphinium,	Larkspur.
		Pulsatilla,	Meadow-anemone.
		Cimicifuga.	Black cohosh.
		Podophyllum,	May-apple.
		Hydrastis,	Golden seal.
Magnoliaceæ.		Magnolia,	Magnolia.
		Illicium,	Star-anise.
Menispermaceæ.		Menispermum,	Canadian moon-seed.
		Calumba,	Columbo.
		Pareira.	Pareira.
		Picrotoxinum,	Cocculus Indicus.
Berberidaceæ.		Caulophyllum,	Blue cohosh.
Papaveraceæ.		Papaver,	Poppy.
		Sanguinaria.	Bloodroot.
		Chelidonium,	Celandine.
Cruciferæ.		Sinapis,	Mustard.
		Armoracia.	Horse-radish.
Violaceæ.		Viola,	Pansy.
Lineæ.		Linum,	Flaxseed.
Geraniaceæ.		Geranium,	Crane's-bill.
Polygaleæ.		Senega,	Senega.
		Krameria,	Rhatany.
Sapindaceæ.		Guarana,	Paullinia.
Erythroxylaceæ.		Erythroxylon,	Coca.
Malvaceæ.		Gossypium,	Cotton.
		Althæa.	Marshmallow.
Aurantiaceæ.		Aurantium,	Orange.
		Limones,	Lemons.
Sterculiaceæ.		Theobroma,	Cacao.
		Sterculia,	Kola.
Ternstrœmiaceæ.		Camellia.	Tea.
Guttiferæ.		Cambogia,	Gamboge.
Canellaceæ.		Canella,	Canella.
Vitaceæ.		Uvæ passæ.	Raisins.
		Vina,	Wines.
Zygophylleæ.		Guaiacum,	Guaiac.
Meliaceæ.		Azedarach,	Pride of China.
Rutaceæ.	Ruteæ.	Ruta,	Rue.
		Cusparia,	Angostura-bark.
		Bergamum,	Bergamot.
	Diosmeæ.	Buchu.	Buchu,
	Xanthoxyleæ.	Xanthoxylum,	Prickly ash.
		Pilocarpus,	Jaborandi.
Simarubeæ.		Quassia,	Quassia.

SUBCLASS II.—CALYCIFLORÆ.

Natural Order.		*Name.*	*Synonym.*
Rhamnaceæ.		Rhamnus purshiana,	Cascara sagrada.
		Rhamnus frangula,	Buckthorn
Celastrineæ.		Euonymus,	Wahoo.
Aquifoliaceæ.		Prinos,	Alder.
Anacardieæ.		Mastiche,	Mastic.
		Rhus glabra.	Sumach.
		Rhus toxicodendron.	Poison-ivy.
Burseraceæ.		Myrrha,	Myrrh.
Leguminosæ.	Papilionaceæ.	Glycyrrhiza,	Licorice.
		Scoparius,	Broom.
		Tragacantha,	Tragacanth.

Natural Order.		*Name.*	*Synonym.*
Leguminosæ.	Papilionaceæ *(continued).*	Santalum,	Saunders.
		Kino,	Kino.
		Balsamum Peruvianum,	Balsam of Peru.
		Balsamum Tolutanum,	Balsam of Tolu.
		Abrus,	Jequirity.
		Physostigma,	Calabar bean.
		Hæmatoxylon,	Logwood.
		Krameria,	Rhatany.
		Chrysarobinum,	Chrysarobin.
	Cæsalpinæ.	Senna,	Senna.
		Cassia,	Purging cassia.
		Tamarindus,	Tamarind.
		Copaiba,	Copaiba.
		Piscidia,	Jamaica dogwood.
	Mimoseæ.	Acacia,	Gum arabic.
		Erythrophlæum,	Sassy-bark.
		Indigo,	Indigo.
Rosaceæ.	Pomeæ.	Cydonium,	Quince.
		Rubus,	Blackberry.
	Dryadeæ.	Rubus idæus,	Raspberry.
	Roseæ.	Rosa,	Rose.
		Cusso,	Kousso.
		Quillaja,	Soap-bark.
	Amygdaleæ.	Amygdala dulcis,	Sweet almond.
		Amygdala amara,	Bitter almond.
		Prunus,	Prune.
		Prunus Virginiana,	Wild cherry.
		Laurocerasus,	Cherry-laurel.
Papayaceæ.	Passifloræ.	Carica papaya,	Papaw.
Myrtaceæ.		Caryophyllus,	Cloves.
		Pimenta,	Allspice.
		Chekan,	Cheken.
		Myrtus,	Myrtle.
		Cajuput,	Cajeput.
		Eucalyptus,	Blue gum.
		Granatum,	Pomegranate.
Cucurbitaceæ.		Colocynth,	Bitter cucumber.
		Elaterium,	Squirting cucumber.
		Pepo,	Pumpkin.
	[mæ.	Bryonia,	Bryony
Umbelliferæ.	Campylosper-	Conium,	Hemlock.
	Orthospermæ.	Asafœtida,	Asafetida.
		Galbanum,	Galbanum.
		Ammoniacum,	Ammoniac.
		Fœniculum,	Fennel.
		Anisum,	Anise.
		Anethum,	Dill.
		Carum,	Caraway.
		Sumbul,	Musk-root.
	Cœlospermæ.	Coriandrum,	Coriander.

SUBCLASS III.—COROLLIFLORÆ.

Natural Order.		*Name.*	*Synonym.*
Caprifoliaceæ.		Sambucus,	Elder.
Cornaceæ.		Cornus,	Dogwood.
Rubiaceæ.	Cinchoneæ.	Cinchona,	Cinchona bark.
	Coffeæ.	Coffea,	Coffee.
		Gambir,	Gambir.
	Enuragoga.	Ipecacuanha,	Ipecac.

Natural Order.	*Name.*	*Synonym.*
Valerianeæ.	Valerian,	Valerian.
Caprifoliaceæ.	Viburnum,	Black haw.
Compositæ.	Pyrethrum,	Pellitory.
	Absinthium,	Wormwood.
	Tanacetum,	Tansy.
	Santonica,	Santonica.
	Anthemis,	Chamomile.
	Matricaria,	German chamomile.
	Eupatorium,	Thoroughwort.
	Taraxacum,	Dandelion.
	Lactuca,	Lettuce.
	Arnica,	Leopard's-bane.
	Calendula,	Marigold.
	Grindelia,	Grindelia.
	Inula,	Elecampane.
	Lappa,	Burdock.
Lobeliaceæ.	Lobelia,	Indian tobacco.
Ericaceæ.	Uva ursi,	Bearberry.
	Chimaphila,	Pipsissewa.
	Gaultheria,	Wintergreen.
Sapotaceæ.	Gutta-percha,	Gutta-percha.
Styraceæ.	Benzoin,	Benzoin.
Oleaceæ.	Olivæ oleum,	Olive-oil.
	Manna,	Manna.
Loganiaceæ.	Nux vomica,	Nux vomica.
	Ignatia,	Bean of St. Ignatius
	Gelsemium,	Yellow jasmine.
	Spigelia,	Pink root.
Apocynaceæ.	Apocynum,	Canadian hemp.
	Aspidosperma,	Quebracho.
	Strophanthus,	Strophanthus.
Asclepiadeæ.	Asclepias,	Pleurisy-root.
	Hemidesmus,	Indian sarsaparilla.
	Condurango,	Condurango.
Gentianeæ.	Gentian,	Yellow gentian.
	Chiretta,	Chirata.
Convolvulaceæ.	Scammony,	Scammony.
	Jalap,	Jalap.
Chenopodiaceæ.	Chenopodium,	American worm-seed.
Solanaceæ.	Scopola.	Scopola.
	Capsicum,	Red pepper.
	Belladonna.	Deadly-nightshade.
	Hyoscyamus,	Henbane.
	Stramonium,	Jamestown weed.
	Tobacco,	Tobacco.
Scrophulariacæ.	Digitalis,	Fox-glove.
	Leptandra,	Culver's physic.
Labiatæ.	Rosmarinus,	Rosemary.
	Lavandula,	Lavender.
	Mentha piperita,	Peppermint.
	Mentha viridis,	Spearmint.
	Thymus.	Thyme.
	Hedeoma,	Pennyroyal.
	Marrubium,	Horehound.
	Melissa,	Balm.
	Origanum,	Wild marjoram.
	Salvia,	Sage.
	Scutellaria,	Skull-cap.
Pedaliaceæ.	Sesami oleum,	Benne oil.

SUBCLASS IV.—APETALÆ.

Natural Order.		*Name.*	*Synonym.*
Polygonaceæ.		Rheum,	Rhubarb.
		Rumex,	Yellow dock.
Phytolaccaceæ.		Phytolacca,	Poke.
Myristicaceæ.		Myristica,	Nutmeg.
		Macis,	Mace.
Laurineæ.		Cinnamomum,	Cinnamon.
		Camphora,	Camphor.
		Sassafras,	Sassafras.
		Coto,	Coto.
Aristolochiaceæ.		Serpentaria,	Snake-root.
		Asarum,	Canada snake-root.
Santalaceæ.		Santali oleum,	Sandal-wood oil.
Thymelaceæ.		Mezereum,	Mezereum.
Euphorbiaceæ.		Elastica,	India rubber.
		Cascarilla,	Sweet wood.
		Stillingia,	Queen's root.
		Tiglii oleum,	Croton oil.
		Ricinus (oleum),	Castor-oil.
		Kamala,	Rottlera.
Piperaceæ.		Piper,	Pepper.
		Cubeba,	Cubebs.
		Matico,	Matico.
Salicaceæ.		Salix,	Willow.
Juglandaceæ.		Juglans,	Butternut.
Hamamelaceæ.		Hamamelis,	Witch-hazel.
		Styrax,	Storax.
Cupuliferæ.		Quercus,	Oak.
		Castanea,	Chestnut.
Urticaceæ.	Ulmeæ.	Ulmus,	Elm.
	Moreæ.	Morus,	Mulberry.
	Artocarpeæ.	Ficus,	Fig.
	Cannabineæ.	Cannabis Indica,	Indian hemp.
		Cannabis Americana,	American hemp.
		Humulus,	Hops.

DIVISION II.—GYMNOSPERMÆ.

Natural Order.	*Name.*	*Synonym.*
Coniferæ.	Pinus sylvestris,	Scotch fir.
	Abies excelsa,	Spruce fir.
	Abies balsamea	Balsam fir.
	Pinus palustris,	Turpentine pine.
	Thuja occidentalis,	Arbor vitæ.
	Juniperus communis,	Juniper oil.
	Juniperus oxycedrus,	Cade oil,
	Juniperus sabina,	Savin.
	Serenoa serrulata,	Saw-palmetto.

CLASS II.—ENDOGENS.

Natural Order.	*Name.*	*Synonym.*
Smilaceæ.	Sarsaparilla.	Sarsaparilla,
Liliaceæ.	Allium,	Garlic.
	Scilla,	Squill.
	Aloe,	Aloes.
	Veratrum viride,	Green hellebore.
	Colchicum,	Meadow-saffron.
Melanthaceæ.	Sabadilla,	Cevadilla.
Orchideæ.	Vanilla,	Vanilla.
	Cypripedium,	Ladies'-slipper.
Scitamineæ.	Zingiber,	Ginger.

Natural Order.	*Name.*	*Synonym.*
Scitamineæ (*continued*).	Cardamomum,	Cardamom.
Irideæ.	Iris,	Blue flag.
	Crocus,	Saffron.
Palmaceæ.	Areca,	Betel-nut.
Aroideæ.	Calamus,	Sweet flag.
Gramineæ.	Farina tritici,	Wheat-flour.
	Avenæ farina,	Oatmeal.
	Amylum,	Starch.
	Triticum,	Couch-grass.
	Hordeum,	Barley.
	Maltum,	Barley-malt.

SUBKINGDOM II.—CRYPTOGAMS.

Natural Order.	*Name.*	*Synonym.*
Filices.	Aspidium,	Male fern.
Lichenes.	Cetraria,	Iceland moss.
	Litmus,	Litmus.
Fungi.	Ergota,	Ergot of rye.
	Ustilago,	Corn-smut.
Algæ.	Chondrus,	Irish moss.

GROUP III.—*Animal Kingdom.*

Class.	*Order.*	*Name.*	*Synonym.*
Mammalia.	Rodentia.	Castoreum,	Castor.
	Ruminantia.	Moschus,	Musk.
		Serum antidiphtheriticum,	Diphtheria antitoxin.
		Glandulæ suprarenales siccæ,	Dried suprarenal glands.
		Glandulæ thyroidea siccæ,	Dried thyroid glands.
		Sevum.	Suet (mutton-suet).
		Adeps lanæ.	Wool-fat (purified).
		Gelatinum,	Gelatin.
		Carbo animalis,	Bone-charcoal.
		Fel bovis,	Ox-gall.
	Pachydermata.	Adeps,	Lard.
		Pepsinum.	Pepsin.
		Pancreatinum,	Pancreatin.
	Cetacea.	Spermaceti,	Spermaceti.
Aves,	Gallinæ.	Ovum,	Egg (of domestic fowl).
Pisces,	Sturiones.	Ichthyocolla,	Isinglass.
	Teleostei (gadidæ).	Morrhuæ oleum.	Codliver-oil.
Insecta.	Hymenoptera.	Mel,	Honey.
		Cera,	Wax.
	Hemiptera.	Coccus,	Cochineal.
	Coleoptera.	Cantharis,	Spanish fly.
Helminthes,	Annelida.	Sanguisuga, or hirudo.	Leech.

In the above comprehensive scheme, which is essentially that of Lauder Brunton's "Pharmacology," remedies are arranged with reference to their natural affinities, and in this classification relationships are manifested which ordinarily might be unnoticed by the student. It will be observed that drugs are derived from various sources, and vary greatly in their properties, physical and chemical. They all agree in one attribute, however, which is of influencing bodily functions in such a manner as to

make them useful in the treatment of diseased conditions. The nature of these effects and the manner of their manifestations it will be the purpose of the following pages to show, especially in Part II, where drugs are discussed individually and in detail.

Scientific Synonyms of New Remedies.[1]

Most of the remedies of recent introduction bear names which give little or no clue either to their chemical composition or therapeutical properties. In preparing the following list of synonyms an effort has been made to give the correct chemical designation of the drug named, as well as the brand, or trade, name adopted by the manufacturers, and it is hoped that the list will prove useful to those who have calls for such remedies under their chemical titles.

Scientific Name.	*Trade Name.*
Acetamidosalol	Salophen
Acetphenetidine	Phenacetin
Acetphenone	Hypnone
Acetylsalicylic acid	Aspirin
Acetylsalicylic acid	Acetysal
Acetylsalicylic acid	Xaxa
Acetyltannin	Tannigen
Acetylsalol	Spiroform or Vesipyrin
Albumin iodoform	Iodoformogen
Aluminum carbonate	Alchol
Aluminum naphtholsulphonate	Alumnol
Amidopyrine	Pyramidon
Amylene hydrochloride	Stovaine
Ammonium ichthyolsulphonate	Ichthyol, Thiolin
Ammonium ichthyolsulphonate.	Ichthosan
Ammonium ichthyolsulphonate	Thigenol
Amylum formaldehyde	Amyloform
Antipyrine acetylsalicylate	Acopyrin
Anhydromethylene sodium citrate	Citarin
Amylene chloral	Dormiol
Antipyrine, caffeine citrate	Migrainin
Antipyrine-ferric chloride	Ferripyrin
Antipyrine-ferric chloride	Ferropyrin
Apomorphinbrommethylate	Euporphin
Argentum (See Silver.)	
Atropin methylnitrate	Eumydrin
Benzolylacetyl peroxide	Acetozone
Benzosulphinide	Saccharin
Benzoyl guaiacol	Benzozol
Benzylmorphine hydrochloride	Peronine
Beta-eucaine mandelate	Euphthalmine
Bismuth albuminate	Bismuthose
Bismuth cinchonidindiiodide	Erythrol
Bismuth dithiosalicylate	Thioform
Bismuth fluorbromphenyl	Fluotal
Bismuth oxiodogallate	Airol
Bismuth betanaphtholate	Orphol
Bismuth methylene digallate	Bismal
Bismuth subgallate	Dermatol
Bismuth chrysophanate	Dermol
Bismuth cinnamylate	Hetoform
Bismuth bilactomonotannate	Lactanine
Bismuth pyrogallol	Helcosol
Bismuth phosphate	Bisol
Brominized oil	Bromipin
Bornyl valerate	Hysterol
Butipyrine	Trigemine
Codeine brommethylate	Eucodeine
Calcium betanaphtholsulphonate	Asaprol
Copper nucleinate	Cuprol
Casein sodium	Nutrose
Chloral ethylcarbonate	Uralium
Chloralformamide	Chloralamide
Cotarnine hydrochloride	Stypticin
Cotarnin phthallate	Styptol
Creosote carbonate	Creosotal
Creosote carbonate	Ciba
Creosote salicylate	Salocreol
Diacetyl morphine	Heroin
Didymium salicylate	Dymal
Diethylbarbituric acid	Veronal
Diethylmalonylurea	Veronal
Diamidophenol hydrochloride	Amidol
Diiodomethyl salicylate	Sanoform
Dioxybenzol-hexamethylenamine	Hetralin
Ellagic acid	Gallogen
Ethyl carbamate	Urethane
Ethylene periodide	Diiodoform
Elixir chloræthanal alcoholate	Somnos
Ethylmorphine hydrochloride	Dionin
Ethyl salicylate	Sal-ethyl
Ethylidene diethylether	Acetal
Ethyl chloride	Kelene
Epinephrin hydrate	Adrin
Ferralbumin	Ferratin
Gelatin formaldehyde	Glutol

[1] From the Report of the Committee on New Remedies of the New York State Pharmaceutical Association for 1906. *American Druggist*, 1906, page 36.

Scientific Name.	*Trade Name.*
Gelatose silver	Albargin
Guaiacol albuminate	Histosan
Guaiacol cacodylate	Cacodyliacol
Guaiacol benzoate	Benzosol
Guaiacol carbonate	Duotal
Guaiacol cinnamate	Styracol
Guaiacol salicylate	Guaiacol-salol
Guaiacol valerate	Geosot
Hexamethylenamine-anhydro-methylene citrate	Helmitol
Hexamethylenamine	Aminoform
Hexamethylenamine	Urapurgol
Hexamethylenamine....	Ammonio-formaldehyde
Hexamethylenamine	Cystamine
Hexamethylenamine	Cystogen
Hexamethylenamine	Formin
Hexamethylenamine	Uritone
Hexamethylenamine	Urotropine
Hexamethylenamine-salicylate..	Saliformin
Hexamethylenamine-ethylbromide..	Bromalin or Bromoformin
Hexamethylenamine-tannin	Tannopin
Hexamethylenamine-quinate.	Chinotropin
Hexamethylenamine-quinate	Chinoformin
Hydrargyrum colloidale	Hyrgol
Iron nucleinate	Ferratogen
Ichthyol albuminate	Ichthalbin
Ichthyolformaldehyde	Ichthyoform
Iron paranucleinate	Triferrin
Iodochloroxychinolin	Vioform
Iodized oil	Iodipin
Isobutylorthocresol-iodide	Europhene
Lactylparaphenetidin	Lactophenin
Lithium quinate	Urosine
Lithium benzoate	Uristamine
Limonin	Citarin
Menthol valerate	Validol
Methylacetanilide	Exalgin
Methylene bromtannin	Bromotan
Methylene dicotoine	Fortoine
Methylene-ditannin	Tannoform
Methylmorphine	Codeine
Methylthionine hydrochloride....	Methylene blue
Mercury, colloidal	Hyrgol
Mercury nucleinate	Mercurol
Mercuric ethylenediamine sulphate	Sublamine
Methylzanthin sodium acetate	Theocine-sodium acetate
Methylenehippuric acid	Hippol
Monochloral-antipyrine	Hypnal
Naphthalol	Betol
Naphthol salicylate	Betol
Naphthosalol	Betol
Nicotine salicylate	Eudermol
Piperazine quinate	Sidonal
Paramidophenol hydrochloride	Rodinal
Pyrocatechindimethyl-ether	Veratrol
Phenylurethane	Euphorin
Phenetidine citrate	Citrophen
Potassium-creosote sulphonate	Sulphosote
Potassium-guaiacol sulphonate	Thiocol
Potassium-guaiacol sulphonate	Kasucolum
Potassium ortho-oxy-chinolinsulphonate	Chinosol
Pyrogallol monoacetate	Eugallol
Pyrogallol triacetate	Lenigallol
Resorcin monoacetate	Euresol
Quinine guaiacol bisulphonate	Guaiquin
Quinine ethyl carbonate	Euquinine
Quinine ethyl carbonate	Aristochin
Quinic acid anhydride	Sidonal, new
Quinine-phenetidine ethyl carbonate	Chinaphenin
Silver citrate	Itrol
Silver citrate	Antiseptic Credé
Silver, colloidal	Collargol
Silver ichthyolsulphonate	Ichthargan
Silver lactate	Actol
Silver proteinate	Protargol
Silver proteinate	Novargan
Silver protalbin	Largin
Sodium acid oleate	Eunatrol
Sapocarbol	Lysol
Sodium oxycyanocinnamate	Zymphene
Sodium lygosinate	Lygosine
Sapocresol	Creoline
Sodium anilarsenate	Atoxyl
Sodium perborate	Euzone
Sodium pyrocatechin monoacetate	Guaiacetin
Sapoformal	Lysoform
Succinic peroxide	Alphozone
Sulphonethylmethane	Trional
Sulphonmethane	Sulphonal
Tannin albuminate	Tannalbin
Tetraiodopyrrol	Iodol
Theobromine sodium acetate	Agurine
Theobromine sodium salicylate	Fibrolysin
Thyminic acid	Solurol
Theobromine sodium salicylate	Diuretin
Thymol carbonate	Thymotal
Thymol iodide	Aristol
Thymol iodide	Annidalin
Thymol iodide	Thymotol
Tribromphenolbismuth	Xeroform
Urea salicylate	Ursal

PHARMACY.

Pharmaceutical Nomenclature and Classification.—In every science it is necesary to follow some system of naming the objects under consideration, and if this be done carefully it is a great assistance to its study and avoids much confusion. Common names, being used by persons who possess but slight knowledge of the subject, are likely to be frequently misapplied and are not sufficiently distinctive. For instance, nitre may mean sodium carbonate or sodium nitrate, as well as potassium nitrate, which is the proper chemical title. Milk-weed designates any common plant having a milky juice, whereas the name Asclepias tuberosa always serves to identify a species of asclepias, without confusion or error. Scientific names are therefore not adopted with the object of making the study of a subject more difficult to the beginner, but really with the view of making its comprehension more easy after he has mastered the details of its technique and nomenclature. It is absolutely necessary for the student of materia medica to have a knowledge of botanical and chemical terms. In the consideration of drugs in the present work, every official drug appears under the title of its Latin chemical or botanical name, with the letters U. S. P. or B. P. added; the common name or synonym is also given. In the case of plants the full botanical name and natural order are usually stated, following the United States Pharmacopœia. The scientific, or botanical, title is given in Latin so as to avoid mistakes, as this is the name by which it would be recognized all over the world, and by which it may easily be identified; whereas, the same common name may be applied to plants of different species having very different physiological actions and medicinal effects. In common language the English name of the remedy is to be used, but in prescriptions the Latin pharmacopœial name should always be employed. Further remarks upon prescription-writing will be found at the end of this section. It is to be understood that throughout these pages the letters U. S. P. after the name of a drug, preparation, or formula indicate the fact that it is recognized by the United States Pharmacopœia, and is official wherever this authority is acknowledged. B. P. similarly indicates that the remedy or preparation is official in the last edition (1898) of the British Pharmacopœia.

The nomenclature of the United States Pharmacopœia is based upon the following rules adopted by the Convention of 1890, through its Committee on Revision, which have also been followed in the more recent edition.

"In the choice of titles of official articles the principle governs that convenience, established custom, and consideration of safety against mistakes through similarity or changes in names, should outweigh purely theoretical considerations or scientific preciseness. In the designation of chemical compounds (oxides, salts, etc.), put the basylous or metallic component first, viz.: sodium chloride, silver nitrate, lithium bromide, lead oxide, etc., instead of writing chloride of sodium, nitrate of silver, bromide of lithium, oxide of lead, etc. In the case of the salts of iron and mercury this change

involves also the use of the respective terms in *ous* and *ic* (ferrous and ferric, mercurous and mercuric) which greatly help to distinguish salts heretofore frequently confounded. As a matter of precaution, however, the distinguishing adjectives, 'corrosive,' 'mild,' 'yellow,' 'red,' etc., have been left in the titles of the respective mercury compounds; for instance, 'Corrosive Mercuric Chloride,' 'Mild Mercurous Chloride,' etc. In the case of complex iron preparations such as the so-called scale salts (Ferri et Ammonii Citras, Ferri et Ammonii Tartras, etc.), which are not true chemical salts, yet all of which contain the iron in a ferric condition, the word iron was left unchanged, to avoid the impression that they are definite, double salts." These changes in nomenclature were retained in the Eighth Revision. In addition a few synthetic remedies were introduced, such as antipyrine, sulphonal, phenacetin, and formin, under their (condensed) chemical titles. Also a few organic remedies were made official.

Pharmaceutical Classes of Remedies.

ACIDA—ACIDS.

Two degrees of relative concentration are usually recognized, and in one case (acetic acid) there are three. The dilute acids are all of uniform 10-per-cent. strength,—one-tenth acid and nine-tenths water,—except dilute nitrohydrochloric, which contains only 7 per cent., and dilute acetic, 6 per cent., while the aromatic sulphuric acid contains 20 per cent. of the official acid, and dilute hydrocyanic acid contains only 2 per cent. of absolute hydrocyanic acid. The official **Acids** are:—

1. Inorganic.

(a) Liquid Acids:—

Acidum hydrobromicum dilutum.
Acidum hydrochloricum.
Acidum hydrochloricum dilutum.
Acidum hydriodicum dilutum.
Acidum hypophosphorosum.
Acidum hypophosphorosum dilutum.
Acidum nitricum.
Acidum nitricum dilutum.
Acidum nitrohydrochloricum.

(a) Liquid Acids (continued):—

Acidum nitrohydrochloricum dilutum.
Acidum phosphoricum.
Acidum phosphoricum dilutum.
Acidum sulphuricum.
Acidum sulphuricum dilutum.
Acidum sulphuricum aromaticum.
Acidum sulphurosum.

(b) Solid Acid:—

Acidum boricum.

2. Organic.

(a) Liquid Acids:—

Acidum aceticum glaciale.
Acidum aceticum.
Acidum aceticum dilutum.
Acidum hydrocyanicum dilutum.
Acidum lacticum.
Acidum oleicum.

(b) Solid Acids:—

Acidum benzoicum.
Acidum camphoricum.
Acidum citricum.
Acidum gallicum.
Acidum salicylicum.
Acidum stearicum.
Acidum tannicum.
Acidum tartaricum.
Acidum trichloraceticum.

The official **Alkaloids** are:—

Aconitina.
Apomorphinæ hydrochloridum.
Atropina.
Atropinæ sulphas.
Caffeina.
Caffeina citrata.
Caffeina citrata effervescens.
Cinchoninæ sulphas.
Cocaina.
Cocainæ hydrochloridum.
Codeina.
Codeinæ phosphas.
Codeinæ sulphas.
Colchicina.
Homatropinæ hydrobromidum.
Hydrastinæ.
Hydrastininæ hydrochloridum.
Hyoscinæ hydrobromidum.
Hyoscyaminæ hydrobromidum.
Hyoscyaminæ sulphas.
Morphina.
Morphinæ acetas.
Morphinæ hydrochloridum.
Morphinæ sulphas.
Pelletierinæ tannas.
Physostigminæ salicylas.
Physostigminæ sulphas.
Pilocarpinæ hydrochloridum.
Pilocarpinæ nitras.
Quinina.
Quininæ bisulphas.
Quininæ hydrobromidum.
Quininæ hydrochloridum.
Quininæ salicylas.
Quininæ sulphas.
Scopolaminæ hydrobromidum.
Sparteinæ sulphas.
Strychnina.
Strychninæ nitras.
Strychninæ sulphas.
Veratrina.

Neutral Principles.

Chrysarobinum.
Elaterinum.
Glycyrrhizinum ammoniatum.
Piperinum.
Salicinum.
Santoninum.

OILS.

1. Expressed or Fixed Oils.

Oleum adipis.
Oleum amygdalæ expressum.
Oleum gossypii seminis.
Oleum lini.
Oleum morrhuæ.
Oleum olivæ.
Oleum ricini.
Oleum theobromatis.
Oleum tiglii.

2. Distilled or Volatile Oils.

Oleum amygdalæ amaræ.
Oleum anisi.
Oleum aurantii corticis.
Oleum betulæ volatile.
Oleum cadini.
Oleum cajuputi.
Oleum cari.
Oleum caryophylli.
Oleum chenopodii.
Oleum cinnamomi.
Oleum copaibæ.
Oleum coriandri.
Oleum cubebæ.
Oleum erigerontis.
Oleum eucalypti.
Oleum fœniculi.
Oleum gaultheriæ.
Oleum hedeomæ.
Oleum juniperi.
Oleum lavandulæ florum.
Oleum limonis.
Oleum menthæ piperitæ.
Oleum menthæ viridis.
Oleum myristicæ.
Oleum picis liquidæ.
Oleum pimentæ.
Oleum rosæ.
Oleum rosmarini.
Oleum sabinæ.
Oleum santali.
Oleum sassafras.
Oleum sinapis volatile.
Oleum terebinthinæ.
Oleum terebinthinæ rectificatum.
Oleum thymi.

Pharmacopœial Preparations.

The U. S. Pharmacopœia presents thirty-six classes of official preparations:—

Latin.		*English.*
1. Acetum.	(Gen. sing., *i* Nom. pl., *a*)	Vinegar.
2. Aqua.	(" " *æ* " " *æ*)	Water (aromatic).
3. Cataplasma.	(" " *atis* " " *ata*)	Poultice.
4. Ceratum.	(" " *i* " " *a*)	Cerate.
5. Charta.	(" " *æ* " " *æ*)	Paper.
6. Collodium.	(" " *i* " " *a*)	Collodion.
7. Confecto.	(" " *i* " " *a*)	Confection.
8. Decoctum.	(not declinable)	Decoction.
9. Elixir.	(Gen. sing., *i* Nom. pl., *a*)	Elixir (cordial).
10. Emplastrum.	(" " *i* " " *a*)	Plaster.
11. Emulsum.	(" " *i* " " *a*)	Emulsion.
12. Extractum.	(" " *i* " " *a*)	Extract.
13. Fluidextractum.	(" " *i* " " *a*)	Fluid Extract.
14. Glyceritum.	(" " *i* " " *a*)	Glycerite.
15. Infusum.	(" " *i* " " *a*)	Infusion.
16. Linimentum.	(" " *i* " " *a*)	Liniment.
17. Liquor.	(" " *oris* " " *ores*)	Solution.
18. Massa.	(" " *æ* " " *æ*)	Pill-mass.
19. Mel.	(" " *lis* " " *lita*)	Honey.
20. Mistura.	(" " *æ* " " *æ*)	Mixture.
21. Mucilago.	(" " *inis* " " *ines*)	Mucilage.
22. Oleatum.	(" " *i* " " *a*)	Oleate.
23. Oleoresina.	(" " *æ* " " *æ*)	Oleoresin.
24. Pilula.	(" " *æ* " " *æ*)	Pill.
25. Pulvis.	(" " *eris* " " *eres*)	Powder.
26. Resina.	(" " *æ* " " *æ*)	Resin.
27. Serum.	(" " *i* " " *a*)	Serum.
28. Spiritus	(" " *us* " " *us*)	Spirit.
29. Suppositorium.	(" " *i* " " *a*)	Suppository.
30. Syrupus.	(" " *i* " " *i*)	Syrup.
31. Tinctura.	(" " *æ* " " *æ*)	Tincture.
32. Tinctura herbarum recentium.	(" " *æ* " " *æ*)	Tincture of fresh herbs.
33. Trituratio.	(" " *onis* Gen. " *ones*)	Trituration.
34. Trochiscus.	(" " *i* " " *i*)	Troche (lozenge).
35. Unguentum.	(" " *i* " " *a*)	Ointment.
36. Vinum.	(" " *i* " " *a*)	Wine.

Aceta, or Vinegars (2).—Liquid preparations made with dilute acetic acid. Strength, 10 per cent.

Acetum opii. Acetum scillæ.

Aquæ, or Aromatic Waters (18).—Watery solutions of volatile substances, formerly prepared by distillation, now commonly made by adding the volatile or essential oil to distilled water, with magnesia and filtering. They are generally used as flavoring agents, and the dose is indefinite, except ammonia, chlorine, and creosote waters. Aqua is potable water in its purest attainable form.

Aqua destillata.
Aqua ammoniæ.
Aqua ammoniæ fortior.
Aqua amygdalæ amaræ.
Aqua anisi.
Aqua aurantii florum.
Aqua aurantii florum fortior.
Aqua camphoræ.
Aqua chloroformi.
Aqua cinnamomi.
Aqua creosoti.
Aqua fœniculi.
Aqua hamamelidis.
Aqua hydrogenii dioxidi.
Aqua menthæ piperitæ.
Aqua menthæ viridis.
Aqua rosæ.
Aqua rosæ fortior.

Cataplasmata, or Poultices (1).—Moist, semi-solid mixtures of soft consistency for external application.

Cataplasma kaolini.

Cerata, or Cerates (6).—Fatty mixtures containing wax, so as to make them firmer than ordinary ointments.

Ceratum.
Ceratum camphoræ.
Ceratum cantharidis.
Ceratum plumbi subacetatis.
Ceratum resinæ.
Ceratum resinæ compositum.

Chartæ, or Medicated Papers (1).—Papers of definite size, treated with drugs.

Charta sinapis.

Collodia, or Collodions (4).—Liquid preparations of collodion:—

Collodium.
Collodium cantharidatum.
Collodium flexile.
Collodium stypticum.

Confectiones, or Confections (2).—Soft, solid preparations made into a paste with sugar.

Confectio rosæ.
Confectio sennæ.

Decocta, or Decoctions.—Liquid preparations of vegetable drugs obtained by boiling with water. A decoction is directed to be made, as a rule, by placing the drug in a suitable vessel, with a cover, and adding 1000 parts of cold water for each 50 of substance used, covering it well, and boiling for fifteen minutes. When cool, it is passed through the strainer, adding enough cold water to bring up the product to 1000 parts. The strength of decoctions of energetic or powerful drugs should be specially prescribed by the physician. In the U. S. Pharmacopœia there are no official decoctions; the British Pharmacopœia has three: Decoctum aloës compositum, D. granati radicis, and D. hæmatoxyli.

Elixiria, or Elixirs (3).—The popularity of this class of remedies is due to their comparatively pleasant taste and to the fact that they contain alcohol and sugar.

Elixir adjuvans.
Elixir aromaticum.
Elixir ferri, quinæ et strychninæ phosphatum.

Emplastra, or Plasters (7).—Solid substances rendered soft and adhesive by heat, so as to be spread upon leather or muslin, of any desired size or shape, for application to the surface of the body to which the plaster is intended to adhere. One is an exception to the general rule that plasters are to be applied with heat: the emplastrum ichthyocollæ, or isinglass-plaster (court-plaster) (U. S. P., 1890), is rendered adhesive by moisture.

Emplastrum adhæsivum.
Emplastrum belladonnæ.
Emplastrum capsici.
Emplastrum hydrargyri.
Emplastrum opii.
Emplastrum plumbi.
Emplastrum saponis.

Emulsa, or Emulsions (3).—Thick liquid preparations containing an insoluble substance (generally an oil or a resin) suspended in a watery menstruum, by the addition of a viscid material.

Emulsum olei morrhuæ.
Emulsum olei morrhuæ cum hypophosphitum.
Emulsum olei terebinthenæ.

Extracta, or Extracts (28).—Preparations of a solid or semisolid consistency, containing the active principles or constituents of drugs, obtained usually by evaporation of alcoholic or watery solutions, the strength being from twice to four times that of the official agent from which they are made. They often contain glycerin, to keep them in a condition to readily make into pills. **Assayed extracts** contain a definite proportion of the active ingredient, determined by chemical analysis. Alcoholic extracts, aqueous extracts, acetic extracts, and ethereal extracts are made with the aid of dilute alcohol, water, acetic acid, or ether. Many so-called active principles, such as leptandrin, macrotin, hydrastin, etc., used by botanic physicians, are simply alcoholic extracts, or impure resins, precipitated from strong tinctures by the addition of water.

Extractum aloës.
Extractum belladonnæ foliorum.
Extractum cannabis Indicæ.
Extractum cimicifugæ.
Extractum colchici cormi.
Extractum colocynthidis.
Extractum colocynthidis compositum.
Extractum digitalis.
Extractum ergotæ.
Extractum euonymi.
Extractum gentianæ.
Extractum glycyrrhizæ.
Extractum glycyrrhizæ purum.
Extractum hæmatoxyli.
Extractum hyoscyami.
Extractum krameriæ.
Extractum leptandræ.
Extractum malti.
Extractum nucis vomicæ.
Extractum opii.
Extractum physostigmatis.
Extractum quassiæ.
Extractum rhamni purshianæ.
Extractum rhei.
Extractum scopolæ.
Extractum stramonii.
Extractum sumbul.
Extractum taraxaci.

Fluidextracta, or Fluid Extracts (85).—Liquid preparations representative of organic drugs, usually alcoholic, hydro-alcoholic, or acetic acid, and are equivalent to strong tinctures. The rule followed, with a few exceptions, is to have these preparations of definite strength, as related to the crude drug, so that one thousand cubic centimetres of the fluid extract represents the active principle of one thousand grammes of the drug. The dose, therefore, is the same, as the rule, in minims as that of the dry, powdered drug in grains.

Fluidextractum aconiti.
Fluidextractum apocyni.
Fluidextractum aromaticum.
Fluidextractum aurantii amari.
Fluidextractum belladonnæ radicis.
Fluidextractum berberidis.
Fluidextractum buchu.
Fluidextractum calami.
Fluidextractum calumbæ.
Fluidextractum cannabis Indicæ.
Fluidextractum capsici.
Fluidextractum chimaphilæ.
Fluidextractum chiratæ.
Fluidextractum cimicifugæ.
Fluidextractum cinchonæ.
Fluidextractum cocæ.
Fluidextractum colchici seminis.
Fluidextractum conii.
Fluidextractum convallariæ.
Fluidextractum cubebæ.
Fluidextractum cypripedii.
Fluidextractum digitalis.
Fluidextractum ergotæ.
Fluidextractum eriodictyi.
Fluidextractum eucalypti.
Fluidextractum euonymi.
Fluidextractum eupatorii.
Fluidextractum frangulæ.
Fluidextractum gelsemii.
Fluidextractum gentianæ.
Fluidextractum geranii.
Fluidextractum glycyrrhizæ.
Fluidextractum granati.
Fluidextractum grindelia.
Fluidextractum guaranæ.
Fluidextractum hamamelidis foliorum.
Fluidextractum hydrastis.
Fluidextractum hyoscyami.
Fluidextractum ipecacuanhæ.
Fluidextractum krameriæ.
Fluidextractum lappæ.
Fluidextractum leptandræ.
Fluidextractum lobeliæ.
Fluidextractum lupulini.
Fluidextractum matico.
Fluidextractum mezerei.
Fluidextractum nucis vomicæ.
Fluidextractum pareiræ.

Fluidextractum phytolaccæ.
Fluidextractum pilocarpi.
Fluidextractum podophylli.
Fluidextractum pruni Virginianæ.
Fluidextractum quassiæ.
Fluidextractum quercus.
Fluidextractum quillaje.
Fluidextractum rhamni purshianæ.
Fluidextractum rhamni purshianæ aromaticum.
Fluidextractum rhei.
Fluidextractum rhois glabræ.
Fluidextractum rosæ.
Fluidextractum rubi.
Fluidextractum sabinæ.
Fluidextractum sanguinariæ.
Fluidextractum sarsaparillæ.
Fluidextractum sarsaparillæ compositum.
Fluidextractum scillæ.
Fluidextractum scopolæ.
Fluidextractum scutellariæ.
Fluidextractum senegæ.
Fluidextractum sennæ.
Fluidextractum serpentariæ.
Fluidextractum spigeliæ.
Fluidextractum stavisagria.
Fluidextractum stillingiæ.
Fluidextractum stramonii.
Fluidextractum sumbul.
Fluidextractum taraxaci.
Fluidextractum tritici.
Fluidextractum uvæ ursi.
Fluidextractum valerianæ.
Fluidextractum veratri.
Fluidextractum viburni opuli.
Fluidextractum viburni prunifolii.
Fluidextractum xanthoxyli.
Fluidextractum zingiberis.

Glycerita, Glycerites (5).—In these preparations, the vehicle for medical substances is glycerin, a liquid obtained by the decomposition of vegetable or animal fats, or fixed oils, and containing not less than 95 per cent. of absolute glycerol, a triatomic alcohol.

Glyceritum.
Glyceritum acidi tannici.
Glyceritum amyli.
Strychninæ phosphatum.
Glyceritum ferri, quininæ et strychninæ phosphatum.

Infusa, or Infusions (3).—These are usually made by pouring boiling water upon vegetable drugs and letting them stand for half an hour in a covered vessel in a warm place, and separating the infusion by straining. When the strength is not otherwise directed by the pharmacopœia or by the prescription of a physician, they are to be made 5-per-cent. strength. The infusions of cinchona (U. S. P., 1890), and of prunus Virginiana are best made with cold water, by percolation. The official ones are not made according to the decimal system.

Infusum digitalis ($1^1/_2$ per cent).
Infusum pruni Virginianæ (4 per cent.).
Infusum sennæ compositum (6 per cent.).

Linimenta, or Liniments (8).—Preparations, oily or alcoholic, or both, containing medicinal substances, and intended for external application to the surface of the body, with friction.

Linimentum ammoniæ.
Linimentum belladonnæ.
Linimentum calcis.
Linimentum camphoræ.
Linimentum cholorformi.
Linimentum saponis.
Linimentum saponis mollis.
Linimentum terebinthinæ.

Liquores, or Solutions (25).—Liquid preparations of non-volatile drugs, generally chemicals, which are wholly soluble in the menstruum employed.

Liquor acidi arsenosi.
Liquor ammonii acetatis.
Liquor antisepticus.
Liquor arseni et hydrargyri iodidi.
Liquor calcis.
Liquor chlori compositus.
Liquor cresolis compositus.
Liquor ferri chloridi.
Liquor ferri et ammonii acetatis.
Liquor ferri subsulphatis.
Liquor ferri tersulphatis.
Liquor formaldehydi.
Liquor hydrargyri nitratis.
Liquor iodi compositus.
Liquor magnesii citratis.
Liquor plumbi subacetatis.
Liquor plumbi subacetatis dilutus.
Liquor potassii hydroxidi.
Liquor potassii arsenitis.
Liquor potassii citratis.
Liquor sodii hydroxidi.

Liquor sodæ chlorinatæ. Liquor sodii phosphatis Liquor zinci chloridi.
Liquor sodii arsenatis. compositus.

Massæ, or Masses (2).—These are soft, solid mixtures of proper consistency to be made into pills.

Massa ferri carbonatis. Massa hydrargyri.

Mellita, or Honeys (3).—Liquid preparations consisting of honey, or honey as a basis.

Mel. Mel depuratum. Mel rosæ.

Misturæ, or Mixtures (4).—Preparations consisting of a liquid used as a vehicle, and containing an agent not soluble in the menstruum employed.

Mistura cretæ. Mistura glycyrrhizæ com- Mistura rhei et sodæ.
Mistura ferri composita. posita.

Mucilagines, or Mucilages (4).—These are rather dense, viscid preparations of gum, or mucilaginous substances, dissolved in water. They are used for suspending insoluble powders or emulsifying oily substances.

Mucilago acaciæ. Mucilago sassafras medullæ. Mucilago ulmi.
Mucilago tragacanthæ.

Oleata, or Oleates (5).—The official oleates are made by dissolving medicinal bases in oleic acid, and are in the form of a soft solid or ointment. Some of the non-official oleates are in the form of dry powder. The official oleates are:—

Oleatum atropinæ. Oleatum hydrargyri. Oleatum veratrinæ.
Oleatum cocainæ. Oleatum quininæ.

Oleoresinæ, or Oleoresins (6).—These are liquid preparations obtained by dissolving oily and resinous matters out of vegetable drugs by means of acetone (except ginger, which is extracted with alcohol). Oleoresins differ from fluid extracts in composition and in strength, being the most concentrated liquid preparations of drugs that are produced. The yield of oleoresin naturally varies, according to the quality of the crude drug, this class of remedies not bearing a uniform relation (of gramme to cubic centimetre), as fluid extracts are required to do.

Oleoresina capsici. Oleoresina cubebæ. Oleoresina piperis.
Oleoresina capsici. Oleoresina lupulini. Oleoresina zingiberis.

Pilulæ, or Pills (14).—Small spherical masses of medicinal substances intended to be swallowed whole; two of the official forms are coated with Tolu (pilulæ ferri iodidi and pilulæ phosphori); the rest are simply treated with dusting-powder. It is the rule among manufacturers also to supply a full line of pills coated with gelatine or with sugar, in order to preserve and render them more pleasant to swallow. Sometimes a coating of keratin is used where it is desired the pills should not be dissolved until reaching the intestinal tract.

Pilulæ aloës. Pilulæ aloës et mastiches. Pilulæ asafœtidæ.
Pilulæ aloës et ferri. Pilulæ aloës et myrrhæ. Pilulæ catharticæ compositæ.

Pilulæ catharticæ vegetabiles.
Pilulæ ferri carbonatis.
Pilulæ ferri iodidi.
Pilulæ laxativæ compositæ.
Pilulæ opii.
Pilulæ phosphori.
Pilulæ podophylli, belladonnæ, et capsici.
Pilulæ rhei compositæ.

Pulveres, or Powders (9).—Drugs in a dry, finely-divided form, generally compounded or mixed.

Pulvis acetanilidi compositus.
Pulvis aromaticus.
Pulvis cretæ compositus.
Pulvis effervescens compositus.
Pulvis glycyrrhizæ compositus.
Pulvis ipecacuanhæ et opii.
Pulvis jalapæ compositus.
Pulvis morphinæ compositus.
Pulvis rhei compositus.

Resinæ, or Resins (4).—Solid preparations of vegetable origin, obtained by extracting with alcohol and precipitating with water, or by distilling the volatile oil from an oleoresin.

Resina (from turpentine).
Resina jalapæ.
Resina podophylli.
Resina scammonii.

Sera, or Serums, are fluids separated from the coagulated blood of a horse, which has been immunized against certain forms of infection. Only one is official at present.

Serum antidiphtheriticum.

Spiritus, or Spirits (20).—Solutions of volatile or aromatic substances, in which alcohol is used as the menstruum.

Spiritus ætheris.
Spiritus ætheris compositus.
Spiritus ætheris nitrosi.
Spiritus ammoniæ.
Spiritus ammoniæ aromaticus.
Spiritus amygdalæ amaræ.
Spiritus anisi.
Spiritus aurantii compositus.
Spiritus camphoræ.
Spiritus chloroformi.
Spiritus cinnamomi.
Spiritus frumenti.
Spiritus gaultheriæ.
Spiritus glycerylis nitratis.
Spiritus juniperi.
Spiritus juniperi compositus.
Spiritus lavandulæ.
Spiritus menthæ piperitæ.
Spiritus menthæ viridis.
Spiritus vini gallici.

Suppositoria, or Suppositories (1).—Only one formula for suppositories is now official, but they are directed to be made extemporaneously by incorporating the medicinal substances with cacao-butter (oleum theobromatis) and shaping them with a mold into small, conical masses, weighing one gramme each, unless otherwise directed. They are intended to be inserted into the rectum and other cavities of the body, where they melt and allow the medicament to come into contact with an absorbing surface. Suppositories of soap and glycerin are largely used as laxatives to empty the lower bowel. Similar preparations of cacao-butter or gelatin, for the urethra or nose, are called buginaria, or bougies.

Suppositoria glycerini.

Syrupi, or Syrups (29).—These popular preparations are strong solutions of sugar in water, containing flavoring and medicinal substances. They are usually made with the aid of heat, for convenience; but, where

heat would be injurious, they are directed to be made by stirring and filtering, or by percolation.

Syrupus.
Syrupus acaciæ.
Syrupus acidi citrici.
Syrupus acidi hydriodici.
Syrupus amygdalæ.
Syrupus aurantii.
Syrupus aurantii florum.
Syrupus calcii lactophosphatus.
Syrupus calcis.
Syrupus ferri idodidi.
Syrupus ferri, quininæ, et strychinæ phosphatum.
Syrupus hypophosphitum.
Syrupus hypophosphitum compositus.
Syrupus ipecacuanhæ.
Syrupus krameriæ.
Syrupus lactucarii.
Syrupus picis liquidæ.
Syrupus pruni Virginianæ.
Syrupus rhei.
Syrupus rhei aromaticus.
Syrupus rosæ.
Syrupus rubi.
Syrupus sarsaparillæ compositus.
Syrupus scillæ.
Syrupus scillæ compositus.
Syrupus senegæ.
Syrupus sennæ.
Syrupus tolutanus.
Syrupus zingiberis.

Tincturæ, or Tinctures (63).—Liquid preparations of vegetable drugs, as the rule, differing from spirits in not containing volatile substances. To this, tincturæ iodi, lavandulæ compositæ, and moschi are exceptions.

Tinctura aconiti.
Tinctura aloës.
Tinctura aloës et myrrhæ.
Tinctura arnicæ.
Tinctura asafœtidæ.
Tinctura aurantii amari.
Tinctura aurantii dulcis.
Tinctura belladonnæ foliorum.
Tinctura benzoini.
Tinctura benzoini composita.
Tinctura calendulæ.
Tinctura calumbæ.
Tinctura cannabis Indicæ.
Tinctura cantharidis.
Tinctura capsici.
Tinctura cardamomi.
Tinctura cardamomi composita.
Tinctura cimicifugæ.
Tinctura cinchonæ.
Tinctura cinchonæ composita.
Tinctura cinnamomi.
Tinctura colchici seminis.
Tinctura digitalis.
Tinctura ferri chloridi.
Tinctura gallæ.
Tinctura gambir composita.
Tinctura gelsemii.
Tinctura gentianæ composita.
Tinctura guaiaci.
Tinctura guaiaci ammoniata.
Tinctura hydrastis.
Tinctura hyoscyami.
Tinctura iodi.
Tinctura ipecacuanhæ et opii.
Tinctura kino.
Tinctura krameriæ.
Tinctura lactucarii.
Tinctura lavandulæ composita.
Tinctura limonis corticis.
Tinctura lobeliæ.
Tinctura moschi.
Tinctura myrrhæ.
Tinctura nucis vomicæ.
Tinctura opii.
Tinctura opii camphorata.
Tinctura opii deodorati.
Tinctura physostigmatis.
Tinctura pyrethri.
Tinctura quassiæ.
Tinctura quillajæ.
Tinctura rhei.
Tinctura rhei aromatica.
Tinctura sanguinariæ.
Tinctura scillæ.
Tinctura serpentariæ.
Tinctura stramonii.
Tinctura strophanthi.
Tinctura tolutana.
Tinctura valerianæ.
Tinctura valerianæ ammoniata.
Tinctura vanillæ.
Tinctura veratri.
Tinctura zingiberis.

Tincturæ Herbarum Recentium, or Tinctures of Fresh Herbs, are directed by the Pharmacopœia to be made of 50 parts of the fresh herb, macerated in 100 parts of alcohol for two weeks, and then filtering the product. No special formulæ are given.

Triturationes, or Triturations (1).—This is a newly-recognized class of preparations, which represent one-tenth of the strength of the crude drug, to every 10 parts of which 90 of sugar of milk are added, and the mixture thoroughly incorporated by trituration. The only official representative is

Trituratio elaterini.

Trochisi, or Troches (9).—Small, flattened, disk-like, solid masses, usually called lozenges. The basis is generally gum and sugar, or fruit-

paste, making a mass which can be slowly dissolved in the mouth, thus medicating the mucous membrane of the mouth and throat.

Trochisci acidi tannici.
Trochisci ammonii chloridi.
Trochisci cubebæ.
Trochisci gambir.
Trochisci glycyrrhizæ et opii.
Trochisci krameriæ.
Trochisci potassii chloratis.
Trochisci santonini.
Trochisci sodii bicarbonatis.

Unguenta, or Unguents (24).—Soft, fatty preparations, melting at the temperature of the body, and suitable for inunction and the administration of remedies by external application and friction.

Unguentum.
Unguentum acidi borici.
Unguentum acidi tannici.
Unguentum aquæ rosæ.
Unguentum belladonnæ.
Unguentum chrysarobini.
Unguentum diachylon.
Unguentum gallæ.
Unguentum hydrargyri.
Unguentum hydrargyri dilutum.
Unguentum hydrargyri ammoniati.
Unguentum hydrargyri nitratis.
Unguentum hydrargyri oxidi flavi.
Unguentum hydrargyri oxidi rubri.
Unguentum iodi.
Unguentum iodoformi.
Unguentum phenolis.
Unguentum picis liquidæ.
Unguentum potassi iodidi.
Unguentum stramonii.
Unguentum sulphuris.
Unguentum veratrinæ.
Unguentum zinci oxidi.
Unguentum zinci stearatis.

Vina, or Wines (10).—Alcoholic preparations in which stronger white wine is the menstruum generally employed.

Vinum album.
Vinum antimonii.
Vinum cocæ.
Vinum colchici seminis.
Vinum ergotæ.
Vinum ferri.
Vinum ferri citratis.
Vinum ipecacuanhæ.
Vinum opii.
Vinum rubrum.

Important Changes in the Eighth Revision of the Pharmacopœia.

Upon the succeeding few pages will be found, arranged in a convenient form for reference, tables showing the comparative strength of the more important pharmacopœial substances and preparations as given in the preceding and the present revision:—

COMPARATIVE TABLE SHOWING THE STRENGTH OF THE MORE IMPORTANT PHARMACOPŒIAL SUBSTANCES AND PREPARATIONS IN THE PRECEDING AND IN THE PRESENT PHARMACOPŒIA.

TITLE	CHIEF CONSTITUENT	PHARM. 1890	PHARM. 8th REVISION.
Acidum Sulphuricum Aromaticum.	H_2SO_3, by weight	About 18.5 per cent.	About 20.0 per cent.
Aconitum	Aconitine, by weight	Standard not fixed	At least 0.5 per cent.
Alcohol	Absolute Alcohol, by weight	About 91.0 per cent	About 92.3 per cent.
Alcohol Dilutum	Absolute Alcohol, by weight	About 41.0 per cent	About 41.5 per cent.
Belladonnæ Folia	Mydriatic alkaloids, by weight	Standard not fixed	At least 0.35 per cent.
Belladonnæ Radix	Mydriatic alkaloids, by weight	Standard not fixed	At least 0.5 per cent.
Caffeina Citrata Effervescens	Citrated Caffeine, by weight	2.0 Gm. in 100 Gm	4.0 Gm. in 100 Gm.
Calx Chlorinata	Available Chlorine, by weight	At least 35.0 per cent.	At least 30.0 per cent.
Cinchona	Alkaloids, by weight	At least 2.5 per cent. Quinine	At least 4.0 per cent ether-soluble alkaloids.
Coca	Ether-soluble alkaloids, by weight	Standard not fixed	At least 0.5 per cent.
Colchici Cormus	Colchicine, by weight	Standard not fixed	At least 0.35 per cent.
Colchici Semen	Colchicine, by weight	Standard not fixed	At least 0.55 per cent.
Conium	Coniine, by weight	Standard not fixed	At least 0.5 per cent.
Emplastrum Belladonnæ	Mydriatic alkaloids, by weight	Standard not fixed	Not less than 0.38 per cent., not more than 0.42 per cent.
Extractum Belladonnæ	Mydriatic alkaloids, by weight	Standard not fixed	1.4 per cent.
Extractum Colchici Cormi	Colchicine, by weight	Standard not fixed	1.4 per cent.
Extractum Hyoscyami	Mydriatic Alkaloids, by weight	Standard not fixed	0.3 per cent.
Extractum Nucis Vomicæ	Strychnine, by weight	15.0 per cent. total alkaloids	5.0 per cent.
Extractum Opii	Morphine (cryst.), by weight	18.0 per cent	20.0 per cent.
Extractum Physostigmatis	Ether-soluble alkaloids, by weight	Standard not fixed	2.0 per cent.
Extractum Stramonii	Mydriatic Alkaloids, by weight	Standard not fixed	1.4 per cent.
Fluidextractum Aconiti	Aconitine, by weight	Standard not fixed	0.4 Gm. in 100 c.cm.
Fluidext'um Belladonnæ Radicis	Mydriatic alkaloids, by weight	Standard not fixed	0.5 Gm. in 100 c.cm.
Fluidextractum Cinchonæ	Anhydrous e.-s. alkaloids, by wt.	Standard not fixed	4.0 Gm. in 100 c.cm.
Fluidextractum Cocæ	Ether-soluble alkaloids, by weight	Standard not fixed	0.5 Gm. in 100 c.cm.
Fluidextractum Colchici Seminis	Colchicine, by weight	Standard not fixed	0.5 Gm. in 100 c.cm.
Fluidextractum Conii	Coniine, by weight	Standard not fixed	0.45 Gm. in 100 c.cm.
Fluidextractum Guaranæ	Alkaloids, by weight	Standard not fixed	3.5 Gm. in 100 c.cm.
Fluidextractum Hydrastis	Hydrastine, by weight	Standard not fixed	2.0 Gm. in 100 c.cm.
Fluidextractum Hyoscyami	Mydriatic alkaloids, by weight	Standard not fixed	0.075 Gm. in 100 c.cm.
Fluidextractum Ipecacuanhæ	Alkaloids, by weight	Standard not fixed	1.75 Gm. in 100 c.cm.
Fluidextractum Nucis Vomicæ	Strychnine, by weight	1.5 Gm. t'l alkaloids in 100 c.cm.	1.0 Gm. in 100 c.cm.

COMPARATIVE TABLE SHOWING THE STRENGTH OF THE MORE IMPORTANT PHARMACOPŒIAL SUBSTANCES AND PREPARATIONS IN THE PRECEDING AND IN THE PRESENT PHARMACOPŒIA (*continued*).

TITLE	CHIEF CONSTITUENT	PHARM. 1890	PHARM. 8th REVISION.
Fluidextractum Pilocarpi	Alkaloids, by weight	Standard not fixed	0.4 Gm. in 100 c.cm.
Fluidextractum Stramonii	Mydriatic alkaloids, by weight	Standard not fixed	0.35 Gm. in 100 c.cm.
Guarana	Alkaloids, by weight	Standard not fixed	At least 3.5 per cent.
Hydrastis	Hydrastine, by weight	Standard not fixed	At least 2.5 per cent.
Hyoscyamus	Mydriatic alkaloids, by weight	Standard not fixed	At least 0.08 per cent.
Ipecacuanha	Alkaloids, by weight	Standard not fixed	At least 2.0 per cent.
Jalap	Alcohol-soluble resin, by weight	12 per cent	At least 8.0 per cent.
	Ether-soluble resin, by weight	Not more than 1.2 per cent	Not more than 1.5 per cent.
Liquor Ferri Chloridi	Anhydrous $FeCl_3$, by weight	37.8 per cent	29.0 per cent.
Liquor Ferri et Ammonii Acetatis	Tincture of Ferric Chloride	2 c.cm. in 100 c.cm	4 c.cm. in 100 c.cm.
Liquor Ferri Tersulphatis	$Fe_2(SO_4)_3$, by weight	28.7 per cent	36.0 per cent.
Lithii Citras Effervescens	Lithium Citrate, by weight	About 17.0 per cent	About 5.0 per cent.
Nux Vomica	Strychnine, by weight	Standard not fixed	At least 1.25 per cent.
Oleatum Hydrargyri	Yellow Mercuric Oxide, by weight.	20.0 per cent	25.0 per cent.
Oleum Amygdalæ Amaræ	Benzaldehyde, by weight	Standard not fixed	At least 85 per cent.
	Hydrocyanic Acid, by weight	Standard not fixed	2 to 4 per cent.
Oleum Cajuputi	Cineol, by volume	Standard not fixed	At least 55 per cent.
Oleum Caryophylli	Eugenol, by volume	Standard not fixed	At least 80 per cent.
Oleum Cinnamomi	Cinnamic Aldehyde, by volume	Standard not fixed	At least 75 per cent.
Oleum Eucalypti	Cineol, by volume	Standard not fixed	At least 50 per cent.
Oleum Limonis	Citral, by weight	Standard not fixed	At least 4 per cent.
Oleum Menthæ Piperitæ	Menthyl Acetate, by weight	Standard not fixed	At least 8 per cent.
	Total Menthol, by weight	Standard not fixed	At least 50 per cent.
Oleum Pimentæ	Eugenol, by volume	Standard not fixed	At least 65 per cent.
Oleum Rosmarini	Bornyl Acetate, by weight	Standard not fixed	At least 5 per cent.
	Total Borneol, by weight	Standard not fixed	At least 15 per cent.
Oleum Santali	Santalol, by weight	Standard not fixed	At least 90 per cent.
Oleum Thymi	Phenols, by volume	Standard not fixed	At least 20 per cent
Opii Pulvis	Morphine (cryst.), by weight	13 to 15 per cent	12 to 12.5 per cent.
Opium Deodoratum	Morphine (cryst.), by weight	13 to 15 per cent	12 to 12.5 per cent.
Pancreatinum	....	Standard not fixed	1 part digests at least 25 parts of starch.
Physostigma	Ether-soluble alkaloids, by weight	Standard not fixed	At least 0.15 per cent.
Pilocarpus	Alkaloids, by weight	Standard not fixed	At least 0.5 per cent.

COMPARATIVE TABLE SHOWING THE STRENGTH OF THE MORE IMPORTANT PHARMACOPŒIAL SUBSTANCES AND PREPARATIONS IN THE PRECEDING AND IN THE PRESENT PHARMACOPŒIA (*continued*).

TITLE	CHIEF CONSTITUENT	PHARM. 1890	PHARM. 8th REVISION.
Potassii Citras Effervescens	Potassium Citrate, by weight	About 48.0 per cent	About 20.0 per cent.
Spiritus Frumenti	Absolute Alcohol, by weight	44 to 50 per cent	37 to 47.5 per cent.
Stramonium	Mydriatic alkaloids, by weight	Standard not fixed	At least 0.35 per cent.
Suppositoria Glycerini	Glycerin, (half their former size)	6 Gm. each	3 Gm. each.
Syrupus Ferri Iodidi	Ferrous Iodide, by weight	About 10 per cent	About 5 per cent.
Tinctura Aconiti	Aconitine, by weight	Standard not fixed	0.045 Gm. in 100 c.cm.
	Aconite	1 Gm. in 2.85 c.cm	1 Gm. in 10.0 c.cm.
Tinctura Aurantii Dulcis	Sweet Orange Peel	1 Gm. in 5.0 c.cm	1 Gm. in 2.0 c.cm.
Tinctura Belladonnæ Foliorum	Mydriatic alkaloids, by weight	Standard not fixed	0.035 Gm. in 100 c.cm.
	Belladonna Leaves	1 Gm. in 6.67 c.cm	1 Gm. in 10.0 c.cm.
Tinctura Benzoini Composita	Benzoin	1 Gm. in 8.33 c.cm	1 Gm. in 10.0 c.cm.
Tinctura Calumbæ	Calumba	1 Gm. in 10.0 c.cm	1 Gm. in 5.0 c.cm.
Tinctura Cannabis Indicæ	Indian Cannabis	1 Gm. in 6.67 c.cm	1 Gm. in 10.0 c.cm.
Tinctura Cantharidis	Cantharides	1 Gm. in 20.0 c.cm	1 Gm. in 10.0 c.cm.
Tinctura Capsici	Capsicum	1 Gm. in 20.0 c.cm	1 Gm. in 10.0 c.cm.
Tinctura Cardamomi	Cardamom	1 Gm. in 10.0 c.cm	1 Gm. in 5.0 c.cm.
Tinctura Cinnamomi	Saigon Cinnamon	1 Gm. in 10.0 c.cm	1 Gm. in 5.0 c.cm.
Tinctura Colchici Seminis	Colchicum Seed	1 Gm. in 6.67 c.cm	1 Gm. in 10.0 c.cm.
	Colchicine, by weight	Standard not fixed	0.05 Gm. in 100 c.cm.
Tinctura Digitalis	Digitalis	1 Gm. in 6.67 c.cm	1 Gm. in 10.0 c.cm.
Tinctura Ferri Chloridi	Anhydrous $FeCl_3$, by weight	13.6 per cent., by weight	13.28 per cent., by weight.
Tinctura Gambir Composita	Gambir	1 Gm. in 10.0 c.cm	1 Gm. in 20.0 c.cm.
Tinctura Gelsemii	Gelsemium	1 Gm. in 6.67 c.cm	1 Gm. in 10.0 c.cm.
Tinctura Hydrastis	Hydrastine, by weight	Standard not fixed	0.4 Gm. in 100 c.cm.
Tinctura Hyoscyami	Mydriatic alkaloids, by weight	Standard not fixed	0.007 Gm. in 100 c.cm.
	Hyoscyamus	1 Gm. in 6.67 c.cm	1 Gm. in 10 c.cm.
Tinctura Kino	Kino	1 Gm. in 10.0 c.cm	1 Gm. in 20.0 c.cm.
Tinctura Lobeliæ	Lobelia	1 Gm. in 5.0 c.cm	1 Gm. in 10.0 c.cm.
Tinctura Nucis Vomicæ	Strychnine, by weight	0.3 Gm. t'l alkaloids in 100 c.cm.	0.1 Gm. strychnine in 100 c.cm.
Tinctura Opii	Morphine (cryst.), by weight	1.3 to 1.5 Gm. in 100 c.cm	1.2 to 1.25 Gm. in 100 c.cm.
Tinctura Opii Deodorati	Morphine (cryst.), by weight	1.3 to 1.5 Gm. in 100 c.cm	1.2 to 1.25 Gm. in 100 c.cm.
Tinctura Physostigmatis	Physostigma	1 Gm. in 6.67 c.cm	1 Gm. in 10.0 c.cm.
	Ether-soluble alkaloids, by weight	Standard not fixed	0.014 Gm. in 100 c.cm.
Tinctura Quassiæ	Quassia	1 Gm. in 10.0 c.cm	1 Gm. in 5.0 c.cm.

COMPARATIVE TABLE SHOWING THE STRENGTH OF THE MORE IMPORTANT PHARMACOPŒIAL SUBSTANCES AND PREPARATIONS IN THE PRECEDING AND IN THE PRESENT PHARMACOPŒIA (*concluded*).

TITLE	CHIEF CONSTITUENT	PHARM. 1890	PHARM. 8th REVISION.
Tinctura Rhei	Rhubarb	1 Gm. in 10.0 c.cm	1 Gm. in 5.0 c.cm.
Tinctura Sanguinariæ	Sanguinaria	1 Gm. in 6.67 c.cm	1 Gm. in 10.0 c.cm.
Tincture Scillæ	Squill	1 Gm. in 6.67 c.cm	1 Gm. in 10.0 c.cm.
Tinctura Serpentariæ	Serpentaria	1 Gm. in 10.0 c.cm	1 Gm. in 5.0 c.cm.
Tinctura Stramonii	Stramonium	1 Gm. in 6.67 c.cm	1 Gm. in 10.0 c.cm.
	Mydriatic alkaloids, by weight	Standard not fixed	0.03 Gm. in 100 c.cm.
Tinctura Strophanthi	Strophanthus	1 Gm. in 20.0 c.cm	1 Gm. in 10.0 c.cm.
Tinctura Tolutana	Balsam of Tolu	1 Gm. in 10.0 c.cm	1 Gm. in 5.0 c.cm.
Tinctura Veratri	Veratrum	1 Gm. in 2.5 c.cm	1 Gm. in 10.0 c.cm.
Trochisci Cubebæ	Oleoresin of Cubeb, by weight	0.25 Gm. in each	0.125 Gm. in each.
Unguentum Chrysarobini	Chrysarobin, by weight	About 5.0 per cent	About 6.0 per cent.
Unguentum Phenolis	Phenol, by weight	About 5.0 per cent	About 3.0 per cent.
Unguentum Sulphuris	Washed Sulphur, by weight	About 30.0 per cent	About 15.0 per cent.
Vinum Album	Absolute Alcohol, by weight	10.0 to 14.0 per cent	7.0 to 12.0 per cent.
Vinum Colchici Seminis	Fluidextract of Colchicum Seed	1 Gm. Colchicum Seed in 6.67 c.cm	1 c.cm. Fluidextract of Colchicum Seed in 10.0 c.cm.
Vinum Ergotæ	Fluidextract of Ergot	1 Gm. Ergot in 6.67 c.cm	2 c.cm. Fluidextract of Ergot in 10.0 c.cm.
Vinum Rubrum	Absolute Alcohol, by weight	10.0 to 14.0 per cent	7.0 to 12.0 per cent.

NOTE.—*The five most important changes are:* (1) The reduction in the morphine-strength of "Powdered Opium" from 13 to 15 per cent. to 12 to 12.5 per cent.; (2) the reduction in the strength of "Syrup of Ferrous Iodide" from 10 per cent. to 5 per cent.; (3) the increase in the strength of "Tincture of Strophanthus" from 5 to 10 per cent.; (4) the reduction in strength of "Tincture of Aconite" from 35 per cent. to 10 per cent.; (5) the reduction in strength of "Tincture of Veratrum Viride" (now "Tincture of Veratrum") from 40 per cent. to 10 per cent.

The new edition of the Pharmacopœia (1905) contains a number of other changes and improvements. Assays have been introduced for the alkaloidal drugs, and other drugs and preparations for which reliable processes can be formulated. The strengths of the tinctures have been amended so as to reduce them practically to two classes,—10 per cent. for the more powerful preparations, and 20 per cent. for the others. Purity rubrics have been inserted which will tend to define the limits of innocuous foreign substances. Of obsolete drugs and preparations 151 have been omitted, and 117 new preparations have been added. Reliable new synthetics have been introduced, and average doses have been indicated for the first time in the history of pharmacopœial revision in America.

Pharmaceutical Processes, or Pharmacy Proper.

Pharmacy is that department of medical science which is devoted to the collection, identification, manipulation, compounding, and dispensing of drugs. It comprises the various articles and preparations composing the Materia Medica, *official* and *non-official;* guards against adulteration and substitution; analyzes the composition and determines the standard proportion of active constituents, besides providing eligible and efficient preparations and indicating the proper procedures in filling prescriptions *secundum artem.* A knowledge of at least the rudiments of pharmacy is absolutely necessary to the practicing physician. It is a great misfortune that so many students are permitted to graduate from our medical schools with such an imperfect acquaintance with practical pharmacy as they ordinarily possess. A very little carelessness or ignorance on the part of the prescriber may cause serious mistakes to be made.

[In practical pharmacy, a number of preparations known as favorite prescriptions or popular remedies, like Squibb's Cholera Mixture, Lafayette Mixture, etc., being in frequent demand, are usually kept on hand in the shops. Some of these, like Brown Mixture, Compound Licorice Lozenges, and Basham's Mixture, have been admitted to the pharmacopœia. Others are less often prescribed, but the pharmacist is expected to have a formula at hand so as to prepare the remedy extemporaneously. Such a collection is known as the "Extra Pharmacopœia," or simply as a Formulary. Some years ago the American Pharmaceutical Association appointed a committee to collect the formulæ for such *unofficial* preparations and to select the best of each class, so as to form a National Formulary. This was done, and the result of the committee's work was fully approved by the American Pharmaceutical Association. The work was issued for the purpose of obtaining uniformity in *unofficial* compounds, and to publish formulæ which represent some proprietary preparations. A "Physicians' Manual of the National Formulary" is published in Chicago, by C. S. Hallberg, at a trifling cost. Every physician will find it useful to have at hand for reference the United States Pharmacopœia, or a good Dispensatory, and also the National Formulary of the American Pharmaceutical Association.]

The principal operations of pharmacy are:—

1. Weighing and Measuring.
2. Determination of Specific Gravity and Temperature.
3. Operations Requiring the Use of Heat.
4. Operations Chiefly Mechanical.
5. Pharmaceutical Testing and Analysis.
6. Extemporaneous Preparations.

1. Weighing and Measuring.—Solids are usually weighed and liquids measured; the denser liquids, however, are often, for the sake of accuracy, dispensed by weight, and all liquids might be. Owing, however, to the variation in bulk of liquids, and the necessity of making corrections for specific gravity and temperature, this plan is not employed in prescribing, although parts by weight have been adopted in our pharmacopœia, which in the last edition has largely followed out the metric system. Scales, or balances, of various kinds and varying degrees of accuracy, are employed

in weighing, and care should be taken that scales used in compounding prescriptions are reliable and sufficiently sensitive for the purpose for which they are used.

Weight is the measure or expression of the attraction of gravitation for a given mass of matter at the earth's surface, being dependent principally upon its bulk, density, and physical condition. The comparative bulk of bodies is expressed in terms of dimension or measurement. Standards of weight and measure are established by law in all civilized countries. Those in use in the United States have been adopted by Act of Congress of June 14, 1836, when the Secretary of the Treasury was directed to furnish each State in the Union with a complete set of revised standards based upon those of Great Britain. In 1864 the use of what is known as the metric system was legalized in Great Britain, but was not made compulsory; and in 1866 the United States pursued the same course. It was finally introduced into the Pharmacopœia in the last two revisions. The measures in common use in handling drugs and compounding prescriptions are as follows: Troy and Avoirdupois weights for ascertaining the relative ponderosity of bodies; Wine, or Imperial, measure for quantity of liquids, and the Metric System for both solids and liquids.

Troy, or apothecaries', weight is used for compounding or dispensing drugs; avoirdupois is the standard for commercial purposes, and is used in buying and selling drugs in quantity.

Troy, or Apothecaries', Weight.

20 grains (symbol gr.)	equal 1 scruple (symbol ℈).
60 grains, or 3 scruples	equal 1 drachm (symbol ʒ).
480 grains, or 8 drachms	equal 1 ounce (symbol ℥).
5760 grains, or 12 ounces	equal 1 pound (symbol ℔ Troy).

Avoirdupois Weight.

437½ grains	equal 1 ounce (symbol oz.).
7000 grains, or 16 ounces	equal 1 pound (symbol ℔ Av.).

The British Pharmacopœia is peculiar in using in its formulæ Avoirdupois weight. As will be noticed above, denominations may be represented by symbols. In Troy or Apothecaries' weight, gr. (Lat. *granum*) stands for grain or grains; ℈ (Lat. *scrupulum*) stands for scruple or scruples; ʒ (Lat. *drachma*) for drachm or drachms, and ℥ (Lat. *uncia*) for ounce or ounces. In prescriptions, as well as in dispensing, these symbols are commonly employed; they will be referred to again under the section on "Prescription-writing."

Fluids, as already stated, may be dispensed by weight; but they are usually measured and sold by quantity.

Apothecaries' Measure.

60 minims (symbol *m*)	equal 1 fluidrachm (symbol f ʒ).
480 minims, or 8 fluidrachms	equal 1 fluid ounce (symbol f ℥).
7680 minims, or 16 fluidounces	equal 1 pint (symbol O).
61440 minims, or 8 pints	equal 1 gallon (symbol C).

An Imperial pint contains twenty fluidounces; there are eight such pints in the Imperial gallon. The latter will contain ten pounds of distilled

water (at 60° F.). The Imperial fluidounce weighs 437.5 grains, which is less by 18.2 grains than the United States Pharmacopœia's ounce of water. This should be remembered in copying prescriptions from English medical publications.

The Metric System of weights and measures is growing in favor, and is employed by nearly all European pharmacopœias, and also by that of the United States. The unit of this system is the metre, which is the ten-millionth part of one-fourth of a meridian, or one forty-millionth of the polar circumference of the earth. This has been found to be a little more than the English yard (3 feet, $3^3/_8$ inches), 39.37 inches. From this unit of length the unit of capacity is derived; a thousandth part of a cubic metre is a litre, which contains a little more than two pints ($2^1/_{10}$ pints); it is represented by a cube whose height is one-tenth of a metre. The unit of weight is obtained by weighing a quantity of distilled water required to fill a cube whose sides measure one one-hundredth of a metre; this is called a gramme, and it is equivalent to 15.432 grains. By a system of prefixes the quantities are readily expressed by multiplication or division; thus, *myria* = 10,000 times, *kilo* = 1000 times, *hecto* = 100 times, *deka* = 10 times; whereas *deci* means $^1/_{10}$, *centi* $^1/_{100}$, and *milli* $^1/_{1000}$. This will be readily understood by referring to the following table, in which the relative values of different denominations in the metric and English systems are approximately given:—

Measures of Length.

$^1/_{1000}$ metre	= 1 millimetre	(mm.),	or	$^1/_{25}$	inch.
$^1/_{100}$ metre	= 1 centimetre	(cm.),	or	$^4/_{10}$	inch.
$^1/_{10}$ metre	= 1 decimetre	(dm.),	or	$3\,^{15}/_{16}$	inches.
1 metre	= 1 METRE	(M.),	or	39.37	inches.
10 metres	= 1 Dekametre	(Dm.),	or	32.81	feet.
100 metres	= 1 Hectometre	(Hm.),	or	328.09	feet.
1000 metres	= 1 Kilometre	(Km.),	or	3280.9	feet.
10000 metres	= 1 Myriametre	(Mm.),	or 32,809 feet, or	$6^1/_4$	miles.

Measures of Capacity.

$^1/_{1000}$ litre	= 1	cubic centimetre (c.cm.), or millilitre	(ml.) =	16	minims
$^1/_{100}$ litre	= 1	centilitre	(cl.) =	2.705	f3.
$^1/_{10}$ litre	= 1	decilitre	(dl.) =	3.381	f℥.
1 LITRE (L.)	= $2\,^1/_{10}$	pints	(O) =	33.815	f℥.
10 litres	= 1	Dekalitre	(Dl.) =	2.641	gallons.
100 litres	= 1	Hectolitre	(Hl.) =	26.419	gallons.
1000 litres	= 1	Kilolitre	(Kl.) =	264.19	gallons.
10000 litres	= 1	Myrialitre	(Ml.) =	2641.9	gallons.

Measures of Weight.

$^1/_{1000}$ gramme,	or 1 milligramme	(mg.) ..... equal to	$^1/_{64}$	grain.	
$^1/_{100}$ gramme,	or 1 centigramme	(cg.) ..... equal to	$^1/_6$	grain.	
$^1/_{10}$ gramme,	or 1 decigramme	(dg.) ..... equal to	1.5	grains.	
1 gramme		(Gm.) ..... equal to	15.432	grains.	
10 grammes,	or 1 Dekagramme	(Dg.) ..... equal to	154.32	grains.	
100 grammes,	or 1 Hectogramme	(Hg.) ..... equal to	3.52	oz. Av.	
1000 grammes,	or 1 Kilogramme	(Kg.) ..... equal to	2.2	℔s Av.	

Relation of Metric Weights and Measures to Apothecaries' Weights and Measures.

1 grain	equals	0.0647895	gramme.
1 scruple	equals	1.295	grammes.
1 drachm	equals	3.887	grammes.
1 ounce	equals	31.103	grammes.
1 minim	equals	0.061613	cubic centimetre (weighing 0.616 gramme, or 0.95 grain.)
1 drachm	equals	3.697	cubic centimetres.
1 ounce	equals	29.57	cubic centimetres.
1 pint	equals	473.11	cubic centimetres.
1 gallon	equals	3785.0	cubic centimetres.

In ordinary use, in prescription-writing, the following table will be found to be nearly correct, and can be easily memorized:—

*m*j equals.....	06	c.cm.	gr. j equals.....	065	gramme.
f℥j equals..... 4		c.cm.	℥j equals..... 4		grammes.
f℥ij equals..... 7	50	c.cm.	℥ij equals..... 8		grammes.
f℥ss equals..... 15		c.cm.	℥ss equals..... 15	5	grammes.
f℥j equals..... 30		c.cm.	℥j equals..... 31	1	grammes.

The use of a decimal line greatly reduces the possibility of mistakes in reading such prescriptions. As 0.06 (drug) is less than 1 grain, while 4.0 and 32.0 (vehicle) are more than the fluidrachm or ounce, there is no danger of giving a stronger dose than was intended by using this system. C.cm. (cubic centimetres), used for Gm. (grammes), causes an error of about 5-per-cent. excess.

A teaspoonful is usually 4 to 5 c.cm.; a tablespoonful, 15.0 c.cm. Since domestic measurements of this kind are so irregular and unreliable, it is best to have the patient take his medicine from a properly graduated glass or a standard spoon.

Ordinary expressions of weight or measure, therefore, may be approximately reduced to metric terms by the following rule: Multiply grains by 6, and the result will be centigrammes; multiply drachms by 4, or ounces by 32, and the result will be grammes. In the same manner, by dividing centigrammes by 6, we obtain grains; or grammes by 4 or 32, and the result will be the number of drachms or ounces, as the case may be.

Liquids are usually measured, when compounding prescriptions, in convenient glass vessels, which, on account of having their capacity graduated by marks blown or engraved upon them, are known as graduates. They are usually smaller at the bottom, having a conical shape, or they may be cylindrical. The indications of capacity may be according to the ordinary apothecaries' liquid measure or to the metric system. Larger quantities are measured in tinned-iron or copper measures, where the liquid is not corrosive; for liquids which cannot be measured in metallic vessels, glass or porcelain can be used. Small quantities are measured by minims or by drops. The only accurate method of regulating the dosage of small quantities is by using a small instrument known as a minim-pipette. This is simply a glass tube, with a slightly contracted extremity, so that it will deliver its contents not too rapidly. Upon the side the tube has graduations engraved upon it. A rubber cap may be applied to the upper extremity, by which fluid may be drawn into the tube when its point is placed under the surface. The desired amount may then be expelled by compressing the cap or bulb, and the amount is indicated by the graduations.

If the pipette is long enough the rubber bulb can be dispensed with and the mouth applied to produce suction, the liquid afterward being retained by placing the forefinger over its upper end, by which also the flow may be regulated. A little experience with this instrument will enable the operator to transfer small quantities of liquid from one receptacle to another with considerable accuracy and rapidity. A good way to keep the pipette ready for use and clean is to use a perforated cork, passing the pipette through it into a bottle containing alcohol or water. When water or any fluid capable of wetting the glass is used the fluid will creep up the sides of the tube by capillary attraction, and the outer edge of the fluid will therefore be higher than the remainder of the surface. In reading the measure it is customary to take the level of the centre of the liquid, or a plane slightly above it, in order to be accurate.

In spite of the fact that every one knows that a drop is not a unit of measure, and that the size and weight of drops of liquid vary according to temperature, specific gravity, and even the shape of the bottle from which they come, and that the drops of some liquids are much larger than others,—for instance, the drop of deodorized tincture of opium being nearly twice as large as that of the ordinary tincture,—physicians constantly prescribe active medicines by drops when they mean minims, if they mean anything at all definite. This uncertainty with regard to drops is shown by the following table,[1] where every attempt to maintain uniformity was observed:—

Acetum opii	90	drops	in 3.70	c.cm.	or 69 minims.
Acetum scillæ	68	"	"	"	"
Acidum aceticum	108	"	"	"	"
Acidum carbolicum	111	"	"	"	"
Acidum hydrocyanicum	60	"	"	"	"
Acidum lacticum	111	"	"	"	"
Acidum phosphoricum dil.	59	"	"	"	"
Acidum sulphuricum aromat.	146	"	"	"	"
Acidum sulphuricum dil.	60	"	"	"	"
Æther fortior	176	"	"	"	"
Alcohol	146	"	"	"	"
Aqua destillata	60	"	"	"	"
Bromum	250	"	"	"	"
Chloroformum purif.	250	"	"	"	"
Creosotum	122	"	"	"	"
Fluidext. belladonnæ radicis	156	"	"	"	"
Fluidext. colchici radicis	160	"	"	"	"
Glycerinum	67	"	"	"	"
Liquor acidi arsenosi	57	"	"	"	"
Liquor arseni et hydrarg. iodidi	58	"	"	"	"
Liquor hydrargyri nitratis	131	"	"	"	"
Liquor iodi comp.	63	"	"	"	"
Liquor potassæ	62	"	"	"	"
Liquor potassii arsenitis	57	"	"	"	"
Oleoresina aspidii	130	"	"	"	"
Oleum caryophylli	130	"	"	"	"
Oleum ricini	77	"	"	"	"
Oleum tiglii	104	"	"	"	"
Spiritus chloroformi	150	"	"	"	"
Syrupus	65	"	"	"	"
Syrupus scillæ	75	"	"	"	"
Syrupus scillæ comp.	102	"	"	"	"

[1] From a table prepared by the late Mr. Stephen L. Talbot. The preparations referred to are of the revision of 1870.

Syrupus senegæ	106	drops	in 3.70	c.cm. or	60 minims.
Tinctura aconita	146	"	"	"	"
Tinctura belladonnæ	137	"	"	"	"
Tinctura digitalis	128	"	"	"	"
Tinctura ferri chloridi	150	"	"	"	"
Tinctura iodi	148	"	"	"	"
Tinctura nucis vomicæ	140	"	"	"	"
Tinctura opii	130	"	"	"	"
Tinctura opii camph.	130	"	"	"	"
Tinctura opii deodorat	110	"	"	"	"
Tinctura veratri viridis	145	"	"	"	"
Vini colchici radicis	107	"	"	"	"
Vini colchici seminis	111	"	"	"	"
Vini opii	100	"	"	"	"

Scientific accuracy in prescribing and in dispensing medicines can only be obtained by carefully measuring or weighing the agent in graduates, or scales, of standard accuracy. Where a fraction of a grain, drop, or minim of some powerful remedy is ordered, the division can be made more evenly by diffusing the remedy in a larger quantity of some menstruum in which it is soluble, like alcohol, ether, water, or by mixing it with some inert powder, like gum arabic. Thus, the one one-hundred-and-twentieth of a grain of atropine may be obtained by dissolving one grain in 480 minims of water, of which four minims would represent the desired quantity. Croton-oil and similar agents can be dissolved in alcohol or diffused through some inert powder, like milk-sugar, and thus be accurately divided into parts smaller than the minim or drop.

Most pharmacists are supplied with a full set of metric weights and measures, and can compound prescriptions in accordance therewith; but there are practical objections and difficulties that stand in the way of the general adoption of the French system which will prevent its general use in prescription-writing for many years, or until they are overcome, as pointed out by Prof. Oscar Oldberg. At the same time those physicians who have been trained according to the metric system may find it easier for themselves to continue to employ it in prescription-writing; they owe it to their patients, however, to see that the prescriptions are sent to a pharmacist sufficiently versed in the system not only to avoid making mistakes himself, but also to qualify him to detect any errors that may have been accidentally made by the physician. The maximum dosage of drugs, according to the usual metrology, is usually known to a drug-clerk, but he may not be as familiar with the doses according to the metric system, and therefore the chances of mistakes in compounding are greatly increased. Bottles are now provided by the manufacturers, which contain definite quantities, according to decimal system, in cubic centimetres or millilitres; and pipettes and graduates, marked in metric equivalents, are for sale in all establishments for the sale of scientific apparatus.

2. Determination of Temperature and Specific Gravity.—In some pharmaceutical operations it is necessary to take into consideration the temperature or relative degree of heat, both of the room in which the work is going on and of the object manipulated. For instance, the laboratory or room may be below zero or above 90 degrees; it usually is about 65 degrees, or between this and 70 degrees, and, where no temperature is specified, it is supposed to be at this point. When it differs much, either above or below, it should be noted, especially when taking the specific gravity of fluids.

The instruments employed in measuring degrees of heat are called

thermometers; they do not indicate absolute heat, but only its relative intensity. Thus, more heat would be required to raise a gallon than an ounce of water 1 degree, and yet the thermometer would register the same in each case. The quantity of heat is calculated in another way,—according to the laws of physics. Thermometers used to indicate the degree of heat are usually made of glass, pure mercury being preferred as the index because it expands uniformly between the freezing-point of water and its boiling-point. On account of the contraction of the glass, old thermometers generally read too high. Where the temperature is important, the thermometer may be compared with a standard, and its variations noted and allowed for. Thermometers should be three years old before being graduated, in order to allow for the shrinkage of the glass, which usually reaches its limit in this time.

Thermometers in this country are usually marked according to Fahrenheit's scale, which commences at 32 degrees below the melting-point of ice and divides the intervening space between this and the boiling-point of water into 212 equal gradations, making 180 degrees between the point at which ice melts and water boils; the degrees above and below these extremes are established by experiment. This form of thermometer is generally employed in this country for laboratory work, and is given the second place by the U. S. Pharmacopœia. In Réaumur's thermometer, which is in use to some extent on the continent of Europe, the freezing-point is 0 degrees and the boiling-point 80 degrees. The Centrigrade, or the thermometer of Celsius, is principally used for scientific work all over the world, and has been adopted in the U. S. Pharmacopœia (1890). The melting-point of ice is zero and the boiling-point of water is 100 degrees, the intervening space being equally divided into degrees Centigrade. The reading in Fahrenheit degrees may be converted into Centigrade by a simple rule. Bearing in mind that the former begins 32 degrees below freezing, which is the zero of the other, and that the space in the former occupying 180 degrees only covers 100 degrees of the latter, we have the following:—

To convert Fahrenheit degrees into Centigrade, subtract 32, multiply by 100, and divide by 180,—the result will be degrees Centigrade.

To convert Centigrade degrees into those of Fahrenheit, multiply by 180, divide by 100, and add 32.

As both scales are in use in clinical medicine, it is necessary for the student to familiarize himself with this calculation and remember the rules.

All thermometers are not equally sensitive; while some reach their maximum reading in one minute, others require three or four minutes, or more, to get up to the proper degree.

The *Specific Gravity* of any substance is an expression of the relative weight of any quantity of the substance as compared with an equal bulk of distilled water at a temperature of 60° F. and under ordinary conditions of atmospheric pressure as indicated by the barometer. It may be ascertained directly in the case of a liquid by placing it in a bottle which, when filled to the same point with distilled water, would contain just 1000 grains of the latter, and weighing it accurately: in this way, by subtracting the weight of the bottle, we get the weight of a quantity of liquid which exactly fills the space that 1000 grains of water would. The result is the specific gravity of the liquid. An easier, though less direct, method is to use specific-gravity beads, which are small, balloon-shaped, glass globes, of

different sizes and weights, so adjusted that they have different degrees of buoyancy. Figures are scratched upon each one, showing the specific gravity of the medium in which it swims indifferently, neither floating nor sinking. These are known as Levi's beads, and are used in cases where a liquid is to be evaporated until it attains a given specific gravity. They are hydrometers having only one specific gravity. An improvement on this, which is in general use, is the mercurial hydrometer, of which two are used,—one for liquids heavier than water and one for liquids lighter than water. The form in general use is that of Baumé, which consists of a closed glass tube, loaded at the lower end with mercury or shot, and having an expansion, just above the weight, containing air, which causes it to float in an upright position. The original scale of Baumé has been superseded by the specific-gravity scale, which is engraved upon the stem of the instrument. Hydrometers are usually floated in cylindrical glass jars, the instrument sinking to a certain depth in liquids to be tested; the degree marked upon the scale cut by the surface of the fluid indicates the specific gravity at the ordinary temperature (60 degrees). Alcoholmeters, elæometers, and lactometers are used for alcohol, oils, and milk, respectively. The urinometer, used in testing urine, is a specific-gravity hydrometer. The best form for this purpose is that manufactured by Dr. E. R. Squibb, of New York, which is remarkably accurate, as it is graded at 77° (F.), which is nearer the usual room-temperature than is 60° (F.).

3. Heat is indispensable in pharmaceutical operations. Any of the ordinary sources of heat may be utilized, but it is found more convenient to use alcohol or illuminating-gas for the majority of the purposes to which heat is essential. The ingenuity of inventors has supplied us with small lamps or stoves, burning alcohol or petroleum, which are most convenient and cleanly. A Bunsen gas-burner, or one of its many modifications, is now an indispensable adjunct to the pharmaceutical laboratory.

The following are the principal procedures requiring heat:—

(*a*) *High Temperatures.*—Ignition, or burning. Fusion, or melting. Calcination, or driving off volatile substances by heat. Deflagration, or burning with the aid of oxygen or some substance, like nitre or potassium chlorate, capable of yielding oxygen. Carbonization, or heating organic substances without exposure to air; the volatile substances escape, and the residue is of a dark color, like charcoal. Torrefaction, or roasting. Incineration, or reduction to cinders by consuming all the carbon. Sublimation, or separation of a volatile solid substance from another not volatile by heat.

(*b*) *Temperatures Less High.*—Among these are the water-bath; steam-bath; glycerin-, oil-, or sand- bath. In the water-bath it is not possible to raise the temperature higher than 212° F., but addition of salt increases the density and raises the boiling-point to 227° F. By using steam under pressure the temperature may be still further increased 100 degrees. Vaporization and evaporation are employed to separate volatile substances from fixed bodies. "When vaporization is used to separate a volatile liquid from a less volatile liquid it is called **evaporation.** When the object sought is the volatile liquid it is called **distillation.** When it is used to separate a volatile liquid from a solid it is called **desiccation, exsiccation,** or **granulation.** When it is used to separate a volatile solid from another body it is called **sublimation.**"

Many of the most useful classes of preparations are made with the aid of heat of moderate degree of intensity. *Infusions* are liquid preparations made by treating vegetable substances with either hot or cold water, but usually the former. The preparation must not be boiled. Cold water is selected as a menstruum when the drug contains some volatile substance which may be dissipated by heat, such as in prunus Virginiana. The general directions given by the pharmacopœia are to take 5 parts of the substance and boiling water q. s. to make 100 parts. "Put the substance into a suitable vessel provided with a cover, pour upon it the boiling water, cover the vessel tightly, and let it stand for half an hour. Then strain, and pass enough water through the strainer to make the infusion weigh 100 parts." In the three official solutions this system is not followed. The infusion of digitalis is only $1^1/_2$ per cent., that of wild cherry is 4, and the compound infusion of senna contains 6 per cent. of senna and 12 each of manna and sulphate of magnesium. The strength of energetic or powerful substances should be specially prescribed by the physician.

Decoctions require not only boiling water, but boiling vegetable substances with water. The general official formula for an ordinary decoction, the strength of which is not directed by the physician nor specified by the pharmacopœia, is based upon the same proportion of ingredients as the infusion, but the process differs. Put the substance into a suitable vessel provided with a cover, pour upon it 100 parts of cold water, cover it well, and boil for fifteen minutes; then let it cool to about 40° C. (104° F.), express, strain the expressed liquid, and pass enough cold water through the strainer to make the product weigh 100 parts. Of the two official decoctions, that of cetraria contains 5 per cent.; that of sarsaparilla comp. contains 10 of sarsaparilla, with 2 each of sassafras, guaiac, and licorice-root, and also 1 of mezereum.

In making extracts, the heat of the water-bath is utilized in evaporating the extract to a pilular consistency. Heat is also employed in making ointments, cerates, suppositories, solutions, in spreading plasters, and a variety of other pharmaceutical manipulations.

4. Some operations are chiefly mechanical; among these are comminution, solution, separation of fluids and solids, filtration, clarification, decoloration, precipitation, crystallization, granulation, dialysis, extraction, expression, percolation, maceration, separation of immiscible fluids, decantation, and siphonage.

Comminution is the process of breaking a solid into small pieces. In the case of herbs, the agent may be broken up by cutting, slicing, or chopping, or, if it be sufficiently dry, it may be ground in a mill or mortar, or it may be rasped or grated. When it is reduced to fragments by being subjected to a succession of blows, the process is called **contusion**. Drugs are frequently cut or sliced and then contused, preparatory to making pharmacopœial preparations, such as infusions, decoctions, or tinctures. For small quantities, the mortar and pestle are generally used, but larger quantities are ground in a drug-mill. Different degrees of fineness of powder may be attained, being regulated by the fineness of the meshes of sieves through which it is to be passed to separate it from the coarser particles and make it uniform. When reduced to a very minute subdivision it is said to be impalpable, because the substance has lost its character of hardness, and is soft and light to the touch. **Very fine** powder passes through a sieve having

eighty or more meshes to the linear inch, and is known as No. 80 powder; **fine** powder passes through a sieve of sixty meshes to the inch and is called No. 60; **moderately fine** powder passes through one having fifty meshes to the inch,—No. 50 powder; **moderately coarse** powder passes through a sieve of forty meshes to the inch,—No. 40 powder; and **coarse** powder is only required to pass through a sieve having twenty meshes to the linear inch, —No. 20 powder. These are the five different degrees of fineness and names to distinguish them adopted by the United States Pharmacopœia. For very fine powders bolting cloth is used, which gives a product as smooth as flour. Levigation is the term applied to a process for reducing solids to a powdered state by adding some liquid in which they are not soluble, the paste thus formed being rubbed up in a shallow mortar or on a glass slab with another piece of glass somewhat bell-shaped, with a solid, flat base, which is known as a muller. When a porphyry slab and muller are used the process is termed porphyrization. Another method is to use an excess of liquid, in which the fine, insoluble powder is suspended, and then decanting the portion of the liquid containing the lighter particles, which is set aside; the fine powder subsequently subsides to the bottom of the receiver, and the supernatant liquid may then be poured off and the powder dried. This is known as **elutriation**; a good illustration is the preparation known as prepared chalk, which is made in this way. By a modification of the latter process the semiliquid, pasty mass, containing the elutriated powder, may be placed in a funnel-shaped receptacle fastened in a wooden frame, having a short leg near its middle, and a handle.

The material having been placed in the receptacle, the apparatus is held in the hand, and the leg tapped slightly upon a table of chalk or other porous substance; the shock of impact causes a small portion to become detached from the rest and to fall in the form of small, conical masses or troches, which, with a little practice, may be made nearly uniform in size. Pastils **(Pastilla)** are small masses of this kind, which are usually made with aromatic substances and used for fumigation. Substances refractory to pulverization, like gold-leaf, may be pulverized by rubbing them into a paste with honey or potassium sulphate, afterward removing the foreign element by washing with water. Camphor is pulverized by the addition of a few drops of alcohol or chloroform, although it may be obtained from the spirit by the addition of water, and elutriation or filtration, and afterward removing the alcohol or water by evaporation. Metallic tin is granulated by agitating melted (fused) tin with chalk-powder, the latter being subsequently removed by washing or by chemical solution with an acid. Phosphorus may be pulverized by heating it in the presence of water until melted and keeping it agitated until cooled. Calomel, calcined magnesia, and sulphur may be sublimed, and by introducing steam an exceptionally fine product is obtained. A coarse powder is produced by evaporating a solution to point of concentration and continuing the evaporation, while stirring the liquid, until all the fluid is evaporated. This process is known as **granulation.** Granular effervescent salts are made by thoroughly mixing the perfectly dry material and moistening the mixture with strong alcohol. The pasty mass is pressed through a sieve, and the granules quickly dried in a hot chamber and packed in hermetically-sealed bottles to exclude the moisture of the air. Pulverization is sometimes preceded by **exsiccation,** by which water of crystallization is driven off; this is usually required for

salts like alum and sulphate of iron, which contain a large proportion of water of crystallization. Some metals, like zinc, are granulated by melting them and pouring them in a fine stream into water. Pepsin and similar adhesive substances are reduced to a powdered state by being dissolved and painted on glass plates, from which, after drying, they are scraped off in fine scales. If a finer powder is needed, a cold mortar, perfectly dry and washed with alcohol, is used. The operation is facilitated by combining some rather hard solid with the powder,—like milk-sugar.

Solution is the process whereby a solid or gaseous substance is made to lose its physical identity by the power of some liquid known as a solvent or menstruum. When the liquid has dissolved some, and will take up no more of the substance, it is called a saturated solution. A simple solution is one which contains the original substance chemically unaltered and will yield it again by evaporation. A chemical solution is one in which some chemical action takes place, and the evaporation of the liquid will yield a body having different chemical properties from the original substance. Solution is favored by agitation and usually by the application of heat. Rapid solution is accompanied by change of temperature and abstraction of heat from surrounding bodies, so that the process may be used as a cooling agency. Freezing mixtures are made in this way. On the contrary, where chemical change occurs, there is apt to be a rise of temperature.

A **decimal solution** contains one part of the substance in ten of the menstruum; a 1-per-cent. solution is a **centesimal solution.** The principal solvents employed in pharmacy are the following:—

Water, preferably chemically pure, or recently distilled, water (as ordinary spring- or river- water contains more or less earthy and organic matter, in solution or suspension) is used in making liquors, medicated waters, infusions, decoctions, solutions, syrups, etc. **Alcohol** is used very largely, and is next in importance to water. As it has antiseptic qualities. solutions with alcohol are not so liable to fermentation, as watery preparations are. Moreover, alcohol is a solvent for many substances that are insoluble in the former menstruum, such as resins, volatile or fixed oils, alkaloids, glucosides, etc., while gum, albumin, and starch are not affected by it. This affords an opportunity of dissolving out the medicinal qualities or principles, and leaving the inert, woody, and starchy matters. In some of the manipulations dilute alcohol is directed, which contains one-half water, or. more correctly, according to the pharmacopœia, it contains about "41 per cent. by weight, or about 48.6 per cent. by volume, of absolute ethyl-alcohol, and about 59 per cent., by weight, of water." Alcohol is the basis of the spirits, elixirs, tinctures, medicated wines, and many of the fluid extracts of the pharmacopœia. Ether, benzol, chloroform, carbon disulphide, acetone, acids, and oils are all recognized as solvents in appropriate cases.

Solids may be separated from liquids, or solutions containing them, by filtration, precipitation, decantation, siphonage, evaporation, and crystallization. **Dialysis** is a process by which a crystallizable substance in solution may be separated from non-crystallizable (colloid) substances. Graham, in 1861, brought out this very useful process, which depends upon the diffusability of certain solutions through porous partitions. The usual form is a circular frame, like a sieve, in which the wire meshes are replaced by a diaphragm of parchment or parchment-paper (made by immersing unsized white paper in a cold mixture of two measures of sulphuric acid and

one of water). The dialyzer is floated upon the surface of water in a proper receptacle, and the mixture to be separated is placed within it. A bladder suspended in a glass jar would answer the same purpose. This process is used to separate alkaloids from organic mixtures, especially for purposes of quantitative testing, crystalloid substances passing out through the dialyzer, leaving colloid substances behind. It is particularly applicable to toxicological investigations.

When the object in view is to separate active principles from the other constituents of drugs, a liquid is employed, termed a menstruum, in which the desired principles are soluble. The principal modes of **extraction** employed by pharmacy, at present, are maceration and expression, percolation, digestion, infusion, and decoction. Maceration requires the drug to be in a coarse powder, contused or properly comminuted. The usual method is to place the powder and menstruum in a large bottle, until the soluble constituents are all taken up: a process which may be facilitated by occasional shaking during a week or more. This was formerly the process employed in making tinctures, and is still followed by the German Pharmacopœia. In this country it is now superseded by the process of percolation, which is much more expeditious, and, when properly done, equally effective. **Percolation,** or displacement, is the process by which a powder packed in a conical or cylindrical receiver known as a percolator is exhausted of its active principles or medicinal qualities by the descent through it of a suitable solvent. **Lixiviation** is the name applied to this process when the substance is first incinerated, as in the process of extracting lye from wood-ashes. The U. S. Pharmacopœia gives specific directions for percolation, which is largely used in making tinctures and fluid extracts, as follows: "The process of percolation, or displacement, directed in this pharmacopœia, consists in subjecting a substance, or mixture of substances, in powder, contained in a vessel called a percolator, to the solvent action of successive portions of a certain menstruum in such a manner that the liquid, as it traverses the powder in its descent to the receiver, shall be charged with the soluble portion of it, and pass from the percolator free from insoluble matter.

"When the process is successfully conducted the first portion of the liquid, or percolate, passing through the percolator will be nearly saturated with the soluble constituents of the substance treated; and if the quantity of menstruum be sufficient for its exhaustion, the last portion of the percolate will be nearly free from color, odor, and taste, other than those of the menstruum itself.

"The percolator most suitable for the quantities contemplated by this pharmacopœia should be nearly cylindrical, or slightly conical, with a funnel-shaped termination at the smaller end. The neck of this funnel-end should be rather short, and should gradually and regularly become narrower toward the orifice, so that a perforated cork, bearing a short glass tube, may be tightly wedged into it from within until the end of the cork is flush with the outer edge of the orifice. The glass tube, which must not project above the inner surface of the cork, should extend from 3 to 4 cm. beyond the outer surface of the cork, and should be provided with a closely-fitting rubber tube, at least one-fourth longer than the percolator itself, and ending in another short glass tube, whereby the rubber tube may be so suspended that its orifice shall be above the surface of the menstruum in the percolator, a rubber band holding it in position.

"The size of the percolator selected should be in proportion to the quantity of drug extracted. When properly packed in the percolator, the drug should not occupy more than two-thirds of its height.

"The percolator is prepared for percolation by gently pressing a small tuft of cotton into the neck above the cork, a thin layer of clean and dry sand then being poured upon the surface of the cotton to hold it in place.

"The powdered substance to be percolated (which must be uniformly of the fineness directed in the formula, and should be perfectly air-dry before being weighed) is put into a basin, the specified quantity of menstruum is poured on, and it is thoroughly stirred with a spatula, or other suitable instrument, until it appears uniformly moistened. The moist powder is then passed through a coarse sieve—No. 40 powders, and those which are finer, requiring a No. 20 sieve, while No. 30 powders require a No. 15 sieve for this purpose. Powders of a less degree of fineness usually do not require this additional treatment after moistening. The moist powder is now transferred to a sheet of thick paper, and the whole quantity poured from this into the percolator. It is then shaken down lightly and allowed to remain in that condition for a period varying from fifteen minutes to several hours, unless otherwise directed, after which the powder is pressed, by the aid of a plunger of suitable dimensions, more or less firmly, in proportion to the character of the powdered substance and the alcoholic strength of the menstruum, strongly-alcoholic menstrua, as a rule, permitting finer packing of the powder than the weaker. The percolator is now placed in position for percolation, and, the rubber tube having been fastened at a suitable height, the surface of the powder is covered by an accurately-fitting disk of filtering-paper, or other suitable material, and a sufficient quantity of the menstruum poured on through a funnel reaching nearly to the surface of the paper. If these conditions are accurately observed, the menstruum will penetrate the powder equally until it has passed into the rubber tube and has reached, in this, a height corresponding to its level in the percolator, which is now closely covered to prevent evaporation. The apparatus is then allowed to stand at rest for the time specified in the formula.

"To begin percolation, the rubber tube is lowered and its glass end introduced into the neck of a bottle previously marked for the quantity of liquid to be percolated, if the percolate is to be measured, or of a tared bottle if the percolate is to be weighed; and, by raising or lowering this receiver, the rapidity of percolation may be increased or decreased as may be desirable, care being taken, however, that the rate of percolation, unless the quantity of material be largely in excess of the pharmacopœial quantities, shall not exceed the limit of 10 to 30 drops in a minute. A layer of menstruum must constantly be maintained above the powder, so as to prevent the access of air to its interstices, until all has been added, or the requisite quantity of percolate has been obtained. This is conveniently accomplished, if the space above the powder will admit of it, by inverting a bottle containing the entire quantity of menstruum over the percolator in such a manner that its mouth may dip beneath the surface of the liquid, the bottle being of such shape that its shoulder will serve as a cover for the percolator.

"When the dregs of a tincture, or of a similar preparation, are to be subjected to percolation, after maceration with all or with the greater portion of the menstruum, the liquid should be drained off as completely as

possible, the solid portion packed in a percolator, as before described, and the liquid poured on, until all has passed from the surface, when immediately a sufficient quantity of the original menstruum should be poured on to displace the absorbed liquid, until the required quantity has been obtained.

"Authority is given to employ, in the case of fluid extracts, where it may be applicable, the process of repercolation without change of the initial menstruum."[1]

Fractional percolation is the same process applied to two successive portions of the powder, the result being identical with repercolation.

Expression is the process of forcibly separating liquids from solids. It is a very ancient method, the best-known form being the wine- or fruit-press. After macerating a crude drug for the desired length of time, the full amount of tincture is obtained by decantation and expression.

Precipitation is the process of separating solid particles from a solution by the action of physical or chemical means. If the precipitate is of lower specific gravity than the liquid it will float upon its surface; if, as usually is the case, it is of higher specific gravity it will sink to the bottom of the receptacle. Precipitates may be curdy, granular, flocculent, gelatinous, crystalline, amorphous, etc. A magma is a thick, more or less tenacious, precipitate. Substances containing albumin are precipitated by heat; light precipitates silver salts; but the most frequent method of precipitation is by chemical action. This is resorted to (1) for the purpose of obtaining substances in the form of a powder, (2) as a means of purification, (3) for testing chemicals, and (4) to isolate chemicals. In assuming the crystalline form some salts take up considerable water, which is known as water of crystallization; the amount varies in different salts, but it is important to bear this in mind with some salts like sulphate of iron or alum, as the water should be expelled by heat before making them into pills or powders. Such salts are liable to deliquesce and become moist or liquid by absorbing more moisture from the air, or in a dry atmosphere they may effloresce from loss of water.

5. Pharmaceutical testing and analysis is the method followed in ascertaining the presence of certain constituents and determining the proportion if present. The methods followed are not different from those employed in organic chemistry and in the laboratory. The pharmacopœia supplies a list of standard reagents for the purpose of applying the tests prescribed in the text. As the processes of analysis are not peculiar to pharmacy, the space will not be taken here to consider them in detail. In practical pharmacy the microscope is indispensable for the recognition of drugs and adulterants and for the examination of crystalline deposits and sediments.

6. The preparation of extemporaneous formulæ is not different in principle from the official, except that some extemporaneous preparations may be ordered which have no relation to the pharmacopœia. For instance, some preparations of the English, German, or other pharmacopœias are occasionally prescribed, or formulæ which are original with the physician. Unofficial articles, or new remedies, are also often included in the magistral prescription, but care should be taken that this is not done to excess. It

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[1] Pharmacopœia of the United States of America, 7th Decennial Revision, p. xl *et seq.*

is by no means creditable to a physician to be constantly trying much-vaunted new remedies or proprietary preparations, and neglecting to use the older remedies of established reputation and of standard composition, which have received the sanction of the pharmacopœia. The art of prescribing will now be taken up for consideration.

PRESCRIPTION-WRITING AND FORMULÆ.

In the progress of the science of medicine it has been found necessary, owing to the accumulation of knowledge, to institute special departments of study, as well as specialties in practice. It having become inexpedient for a physician to collect his own herbs in the fields, to make his own preparations, and to dispense his own prescriptions, these duties have been delegated and entrusted to the trained pharmacist and his assistants, who have special qualifications for the task, to which they devote their whole time and attention. This division of labor is to the advantage of scientific medicine, as the practitioner of medicine is relieved of routine work and has more leisure to devote to the study of pathology, diagnosis, and therapeutics.

The Prescription.—The physician usually writes his directions, regarding the medicines which the patient is to take, according to a general form, the writing being called "the prescription" (*præscribo, præscriptum, præscriptio,* in Latin,—something written for, or ordered; in French, *ordonnance*). As a prescription furnishes very tangible evidence of the attainments of a physician, and, being preserved on the prescription-file of the pharmacist as a matter of record, may confront him in the courts of justice, it is of considerable importance that students should be well drilled in prescription-writing before graduating, so that they may be spared mortification and possibly the loss of reputation, caused by blunders or carelessly-written formulæ, to say nothing of the risk to the patient.

The first point to be settled, in composing a prescription, is to determine the therapeutic indication and to decide upon the drug to be employed, and in what form it shall be given,—whether solid or liquid, and whether alone or combined with other remedies. Following this is the question of dosage and the number of doses and length of time during which the remedy is to be given, which determines the quantity to be ordered in the prescription. The body of the prescription, or the formula, may have the quantities written according to the metric system, but, as pharmacists and physicians are more familiar with apothecaries' weights and measures, it is better—for present purposes, at least—to follow the prevailing method, as a matter of precaution, and to prevent mistakes. It has been found that, by adopting a certain form in writing prescriptions, the work of compounding and dispensing is made easier and more certain, and the task of translation facilitated. In framing a prescription, certain principles should be kept in mind, in order that the product shall be creditable and accomplish the purpose for which it was written. The tendency of the day is toward simplicity, the elegant pharmaceutical preparations at our command having removed the necessity of the resort to **polypharmacy,** as it is called, when a large number of agents are combined in one prescription. As remedies

are modified in their action by association with others, it is often advantageous to make such a combination, and knowledge and experience are sometimes displayed to a marked advantage in originating such complex formulæ. Instances of this will be abundantly given in the section devoted to the consideration of drugs. It used to be the rule that a prescription should contain four parts,—(1) the base, (2) the adjuvant, (3) the corrigent, and (4) the vehicle; the dose of the first having been decided upon, the quantities of the other ingredients were made to correspond with it, so as to make the desired quantity of the medicine to be taken at a dose. The preparations of the pharmacopœia, as a rule, may be prescribed without addition, except with water, or some other convenient diluent, when administered.

The first rule in prescribing should be to make a judicious selection of the active remedy or remedies to constitute the basis of the prescription, always taking a single remedy, unless a distinct advantage can be gained by using others in conjunction with it. In this connection, it should be noted that some drugs can be given in larger doses when thus combined, whereas others must have their doses reduced. As a general rule, where agents are from the same therapeutical class they mutually enhance each other's effects, and must be given in smaller doses than when given alone; when they belong to different classes, and especially when they act upon different organs, the dose can often be largely increased with advantage. Having settled upon the main remedy and its associate, and the quantity desired to be given, the question of eligibility comes up, in deciding upon the special pharmaceutical form to be employed. There are frequently representatives of the drug in question in several pharmaceutical classes,—some in solid form, others liquid,—each having, or supposed to have, some special application or advantage in certain cases, and offering favorable opportunities for combination. It may be a matter of indifference which form or preparation of the remedy is chosen, but the probabilities are that it is not; and that some are better suited than others. Thus, some of the preparations of iron are astringent, others acid; others contain alcohol, or are combined with tonics and alteratives; one combination is especially diuretic, another is used as styptic, and rarely given internally; one is used only as an antidote for arsenical poisoning, and so on.

Having decided upon the principal therapeutic agent, if we conclude to give it alone, that will complete the prescription formula, and we have only to add the directions to the pharmacist and to the patient (the latter directions being simply what is desired to be copied upon the label of the medicine-bottle or package). If we wish to combine our remedies, the following objects may govern our selection: First, an addition may be made of some agent which will assist the action of the main ingredient, or two or more may be selected which mutually aid each other. This aid may be chemical in character, as where dilute sulphuric acid is added to quinine sulphate to help in its solution, or hydrochloric acid is added to a digestive mixture containing pepsin; or it may be physiological, and intended to act upon some associated organ, so as to make the effect of the remedy more favorable; or thirdly, to prevent some incidental, disagreeable result. An example of the former is where resin-bearing purgatives, or cholagogue agents, and a sedative like belladonna or hyoscyamus are introduced into a purgative pill; an example of the latter is where hydrobromic acid is added

to a cinchona preparation to prevent noises in the ears, or where carminatives are combined with a cathartic remedy, or the unpleasant effects of morphine are prevented by combining with it a small proportion of atropine. The object, not infrequently, may be purely pharmaceutical, as where a dry powder, as an excipient, is added in making pills. The third object of administering remedies in combination is to obtain as pleasant, or at least as unobjectionable, a form as possible.

When a remedy is exhibited in a form that the patient is utterly unable to swallow it, or is so repulsive that each dose causes nausea or vomiting, no matter how correct the prescription may be from the therapeutic standpoint, the patient will pronounce it a failure, and will probably relieve his feelings by uttering maledictions upon the doctor. On the other hand, if the remedy be attractive in appearance and pleasant to the taste, it will be regarded as a signal success, even though of less therapeutical activity. An agent is sometimes given merely for the mental and moral effect, without having any medicinal action directly. Such a combination is called a **placebo,** because it is administered simply to please the patient. Although placebos are rarely resorted to, patients should always be well treated, and with a little care much can be done toward making preparations pleasant. In choosing a physician, the voice of the patient would, in the majority of cases, be given, without hesitation, in favor of the prescriber who orders pleasant medicine, over him who has a special reputation for giving intolerably nasty ones. The young physician can get a hint from this which may greatly contribute to his success in after-life. Hence, a practical acquaintance with the expedients which modern elegant pharmacy offers, for overcoming the objectionable character of remedies, is of the highest service, has no mean intrinsic value from a financial point of view. A few suggestions for prescribing may be given here. Solid medicines may be given in compressed pills, coated with chocolate, in pills sugar- or gelatin- coated, in hard or soft capsules, or in suppositories. Powders can be given in *cachêts de pain,* gelatin capsules, or suspended in a dense syrup or other vehicle (such as stewed fruit or currant-jelly). Soluble or fluid agents, if unpleasant, are more difficult to hide, but they may be given in combination with aromatic or orange elixir, some fruit-syrup or in aromatic water. Many illustrations will appear, and formulæ will be given of good forms of combination, in the discussion of individual drugs under each head. A proper understanding and appreciation of this principle of combination will not only make the remedies more effective, but the patient will be less likely to forget to take his medicine, and thus will co-operate with the physician rather than oppose him in every possible way. This is seen to the best advantage in the management of sick children, where the remedies must be palatable or the struggles of the child to escape a nauseous dose may cause the attendant to give up in despair and conclude that the excitement may do the child more harm than the medicine will do him good.

In combining our remedies the question of incompatibility demands consideration. Remedies may be (1) pharmaceutically incompatible, (2) chemically incompatible, or (3) physiologically incompatible. Agents are pharmaceutically incompatible when the proposed combination is either impracticable or extremely undesirable. Thus, the addition of water to a tincture of a resin-bearing drug precipitates the resin, or oleoresin, which floats upon the surface, thus spoiling the appearance of the preparation, and

possibly permitting too large a quantity of the active principle to be taken with the first doses from the bottle. As a rule, such tinctures should not be combined with solutions, aromatic waters, or infusions. Preparations of vegetable drugs containing tannic or gallic acid should not be prescribed with iron, as this combination produces an unsightly mixture, and the iron is precipitated in an insoluble form. A survey of the Materia Medica will afford many instances of the ineligibility of particular remedies in certain forms of combination. Volatile and corrosive substances, or hygroscopic bodies, should not be given with powders; bulky drugs should not be added to pills. In alkaloids of great physiological activity, such as strychnine, delphinine, or aconitine, the pill-form should not be resorted to on account of the danger of unequal mechanical division, and, in solution, it should be seen to that nothing be added that would render them insoluble. Some of the combinations, inexpedient from a pharmaceutical standpoint, are as follows:—

(*a*) *Form Explosive Compounds.*—Chlorate of potassium and tannic or gallic acid. Bromide and alcohol. Nitrate of silver and creosote, or vegetable extracts containing glucose. Iodine and solutions of ammonia. Chromic acid and glycerin. Chloride of lime with sulphur. Spirit of nitric ether with certain fluid extracts. Calcium or sodium hypophosphite, with dry powders, or when triturated alone.

(*b*) *Form Unsightly or Undesirable Mixtures.*—Chloral with solutions containing alcohol. Vegetable tinctures containing oils and resins with water. Spirit of nitrous ether with potassium iodide, iron sulphate, tincture of guaiac, antipyrin, mucilage, tannic and gallic acids. Compound infusion of gentian with infusion of wild cherry or of cinchona. Copaiba and oils with watery preparations (unless suspended by acacia or other emulsifying agent). Acids with ammoniated glycerrhizin.

Chemical incompatibility is caused by chemical decomposition with the production of a compound (salt) having characters and reaction different from its components. It should be avoided, as the rule, except where expressly intended by the prescriber. A knowledge of chemistry will generally put the physician upon his guard, but there are special illustrations, which must be borne in mind, where the combination is particularly undesirable, and, when ordered in a prescription, will defeat the object of the treatment and bring discredit upon the attendant. The general rules of chemical incompatibility are usually stated as follows:—

As a rule, a remedy is not to be ordered in combination with its antidotes and chemical tests, especially if the latter depend upon the formation of an insoluble precipitate or a corrosive or poisonous salt. Thus, alkaloids are usually precipitated by mercurials and other metals, and may be destroyed by compounds containing free chlorine, caustic alkalies, or potassium permanganate. Tannic and gallic acids usually precipitate the alkaloids in a nearly insoluble form. The alkalies usually cause precipitation when added to solutions of metallic salts. Glucosides are decomposed by free acids or by emulsions.

Special incompatibilities will be studied in connection with individual drugs. Among those that are most likely to give trouble are preparations containing corrosive chloride of mercury, silver nitrate, solutions of iodine and iodides, arsenic, lead, quinine, strychnine, and tannic acid, and, as the rule, such combinations should be avoided and the agents given by them-

selves or simply in some vehicle. Care should be taken in mixing powerful oxidizing agents with easily-combustible bodies. Among the former are chromic acid, concentrated nitric or nitrohydrochloric acid, potassium chlorate or permanganate. Some of the latter are oils, alcohol, ether, glycerin, sulphur, and phosphorus. Mixtures of chromic acid and glycerin or alcohol, as already stated, are explosive; so is silver nitrate with a vegetable extract, or glucose. Compressed tablets of potassium chlorate sometimes explode from slight friction.

Incompatibilities of Some New Remedies.[1]—The task of avoiding incompatibilities in the dispensing of the newer remedies of synthetic origin has become correspondingly difficult with their increasing number.

A favorite method nowadays with some physicians is to prescribe a large variety of drugs in wafers. Many remedies, however, are unsuitable for dispensing in wafers, because they attract moisture and soften the wafers. Among these are sodium bromide, calcium chloride, strontium chloride, chloral, the glycerophosphates, piperazine, and the dry vegetable extracts from drugs obtained by desiccation *in vacuo*. Iodides should not be prescribed in wafers, as they decompose or change color.

Some of the pharmaceutical incompatibilities are due to the fact that the mixture of some solids produces a liquid. Thus, camphor mixed with naphthol makes a liquid, while antipyrine and sodium salicylate give rise to a semi-liquid, pasty mass. Antipyrine gives also an oily liquid with chloral, betanaphthol, salol, resorcin, phenol, pyrogallol, thymol, and urethane.

Acetanilide is incompatible with chloral, thymol, resorcin, and menthol.

Betanaphthol should not be mixed with antipyrine, camphor, menthol, phenol, and urethane.

Camphor should not be dispensed with betanaphthol, chloral, exalgine, menthol, phenol, pyrogallol, resorcin, salol, thymol, and urethane.

Camphor monobromide is incompatible with chloral, phenol, salol, and thymol.

Chloral is incompatible with acetanilide, camphor, camphor bromide, exalgine, menthol, methacetine, phenacetin, phenol, salol, thymol, and urethane.

Exalgine is incompatible with chloral, naphthol, menthol, phenol, pyrogallol, resorcin, salol, thymol, and salicylic acid.

Menthol cannot be mixed with naphthol, chloral, phenol, pyrogallol, resorcin, salol, thymol, and urethane.

Sodium salicylate should not be dispensed with antipyrine and phenol.

Phenacetin is incompatible with naphthol, chloral, and phenol. Phenol decomposes antipyrine, naphthol, camphor monobromide, camphor, chloral, exalgine, menthol, methacetine, sodium salicylate, pyrogallol, resorcin, salol, thymol, and urethane.

Pyrogallol is incompatible with antipyrine, camphor, exalgine, menthol, and phenol.

Resorcin forms new compounds with acetanilide, camphor monobromide, exalgine, naphthol, menthol, methacetine, phenol, and urethane.

Salol reacts with antipyrine, camphor, camphor bromide, chloral, exalgine, phenacetin, pyrogallol, and thymol.

Thymol is incompatible with acetanilide, antipyrine, camphor, chloral, exalgine, menthol, phenol, salol, and urethrane.

Urethane should not be dispensed with antipyrine, naphthol, camphor, chloral, exalgine, phenol, pyrogallol, resorcin, salicylic acid, salol, or thymol.

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[1] From the Report of the Committee on New Remedies of the New York State Pharmaceutical Association for 1906. *American Druggist*, 1906, p. 37.

Great care should be taken in preparing mixtures of syrups containing acacia with certain phenol derivatives and synthetics. Incompatibilities are apt to occur as the result of the presence of an oxidizing ferment or oxydase in the gum, in virtue of which chemical changes take place, either resulting in a precipitation or a change of color. Witness, for example, the following combination which occurs in an article by Tanzi, quoted in *Répertoire de Thérapeutique*:—

Pyramidon	0 | 20	Gm.
Sodium bromide	0 | 25	Gm.
Syrup of gum acacia	130	Gm.

This mixture at once turns a bluish-violet, then violet, then pink, and after a few hours becomes yellow.

Syrup of acacia gives a blue color with guaiacum resin; a pink color turning black with phenol; a violet color, and later a blue precipitate with alphanaphthol; a grayish white opacity with betanaphthol; a yellowish-brown color and a garnet precipitate with pyrocatechin; a white precipitate with vanillin; and a deposit of white crystals of oxy-morphine with morphine hydrochloride. Syrup of acacia is also incompatible with eserine, adrenalin, syrup of tar, and the liquid preparations of aloes.

Physiological incompatibility is based upon the physiological action of drugs, the rule being that drugs having dissimilar effects upon special organs should not be combined in one prescription, especially where the principal action of the drugs is antagonistic. Inasmuch as the effects of individual remedies are not restricted to one organ or set of organs, and as it never happens that two drugs will be found exactly opposed to each other throughout their whole range of action, considerable latitude in this respect is permitted in prescribing. In fact, there is sometimes an advantage in modifying the activity of a drug by one which is antagonistic. For instance, morphine and atropine are opposed in their effects, and yet atropine is very frequently added to an opiate to diminish the disagreeable effects,—headache, nausea, and constipation,—and heighten the sedative and anodyne qualities. Illustrations of such incompatibility are largely to be found under the antidotes to the toxic effects of drugs, a remedy being considered incompatible with its physiological antagonists, as the general rule. Some prominent illustrations are the following:—

Acetanilide: Alcohol, ammonia, caffeine, cardiac stimulants.
Aconite: Alcohol, ammonia, atropine, amyl nitrite, digitalis, strophanthus, strychnine.
Agaricus albus: Opium, strychnine, pilocarpine.
Agaricus muscarius: Atropine, digitalis, stimulants.
Alcohol: Ammonium, acetate, digitalis, strychnine, caffeine, hyoscyamine.
Atropine: Aconitine, chloral-hydrate, hydrocyanic acid, jaborandi, muscarine, morphine, physostigmine (eserine).
Caffeine: Opium.
Chloral-hydrate: Ammonium salts, atropine, alcohol, many alkaloids.
Chloroform: Amyl nitrite, ammonia, digitalis, strychnine.
Digitalis: Aconite, muscarine, saponin.
Gelsemium: Opium, atropine, strychnine.
Hydrocyanic acid: Atropine, hyoscyamine.
Morphine: Atropine, caffeine, nicotine, physostigmine.
Muscarine (see Agaricus muscarius).
Opium: Atropine, gelsemium, veratrum viride, potassium permanganate.

Physostigmine: Atropine, chloral-hydrate, morphine.
Saponin: Digitalis, strophanthus.
Strychnine: Amyl nitrite, chloral, potassium bromide, chloroform, etc.
Veratrum viride: Opium.

The risks of incompatibility in prescribing can be entirely avoided if due precaution is taken. Whenever a new or unfamiliar combination is ordered, the careful prescriber will, if possible, supervise the preparation of the prescription, and examine the completed product. If an insoluble precipitate be formed, it should be at once investigated and its character determined. Very often a skilled pharmacist will be able to detect an incompatibility in a prescription, owing to his practical acquaintance with the combining of drugs, and in this way point out the fact that such an unintentional incompatibility may exist, and thus show his willingness to work with the physician. It is expected by the general community that a physician should be able to recognize a remedy or preparation by its physical characters alone. In order to do this it will be necessary for him to cultivate a close acquaintance with drugs and the results of combinations which he wishes to order, so that he may pronounce a verdict upon a preparation and decide whether or not it is properly compounded. If he has not such technical knowledge, he should make it his business to acquire it in a laboratory or a pharmacy.

Form and Language of the Prescription.—For many reasons formulæ are usually written in the Latin language. However, if any physician choose to write his prescriptions entirely in English he is at liberty to do so; but the demands of accuracy require that he write the official English titles without abbreviation. Such titles as muriate of ammonia, balsam of copaiba, saltpetre or nitre, brown mixture, spirit of turpentine, etc., may be used in conversation, but in prescriptions the correct titles should be given; either **ammonii chloridum** or ammonium chloride; **copaiba** (not balsam); **potassii nitras** or potassium nitrate; **mistura glycyrrhizæ composita** or compound licorice mixture; **oleum terebinthinæ rectificatum** or rectified oil of turpentine, and so on. Many popular titles are very objectionable; thus, oxalic acid is sometimes called essential salt of lemons or salt of sorrel, lead acetate is called sugar of lead, while an attempt to trace the vulgar names of plants leads to endless confusion. Sometimes preparations of different strength may be indicated; thus, prussic acid may mean concentrated acid or the official 2-per-cent. dilute acid; oil of almonds may mean oil of sweet almonds or oil of bitter almonds, which differ very much in their properties and effects. The only safe rule, therefore, in writing prescriptions, is to know exactly what is intended to be ordered and to legibly write the scientific name and quantity of the article desired, and if this is done, the language may be left to the choice of the prescriber. As a rule, it will be found that physicians who are competent to do so prefer to write in Latin, and those who cannot write them correctly in the language of the pharmacopœia cannot write them correctly in English either.

As to the *status* of a prescription, although really a communication from a physician to the pharmacist, directing the preparation of the remedy, by tacit consent of all parties it is generally admitted to be the property of the patient, who has the privilege of having it repeated or refilled at his pleasure. When the prescription is marked "not to be repeated," the patient is understood to assume all the responsibility of an injury which he may

experience from disobedience to the physician's directions, the ordinary pharmacist generally satisfying his conscience by calling attention to the fact that the physician did not desire the remedy to be continued, and declaring that the entire responsibility must rest with the patient, but filling the prescription just the same. In this way the alcohol habit, the opium habit, the chloral habit, the cocaine habit, the antipyrin or bromide habit are fostered by the resources of modern pharmacy, which presents these agents in the form of cordials and other attractive preparations; so that physicians hesitate to prescribe them, for fear of the consequences of making patients acquainted with these seductive preparations, as there is practically no restriction on their sale. It is only just to add that there are many honorable pharmacists to whom the above remarks do not apply, and who endeavor to co-operate with the physician and who practice pharmacy as a special department of the practice of medicine.

Besides the formula, the complete prescription contains instructions to the pharmacist concerning the combining or compounding of the medicine and directions to the patient as to the dose of, and the manner and time of taking, the preparation. Finally the document must be signed and dated, and, as a matter of precaution, it is advisable to write upon it the patient's name and address, so that, if the pharmacist should make a mistake or deliver the wrong medicine, he will be able to trace it at once. This is also a safeguard against error in administration where more than one patient is under treatment in a family or institution. Many physicians require the formula to be copied upon the label, a plan that is often very useful.

Proceeding to the actual framing of prescriptions, assuming a knowledge of the Materia Medica and pharmacopœial titles sufficient to enable the prescriber to determine what remedy he wishes to give and its dosage, he writes, as legibly as possible, upon a piece of paper, the formula that he has in his mind, making the case endings agree with the requirements of the situation. For instance, as the first word is "Recipe," the imperative mood of the verb "take" requiring the accusative case, it follows that the nouns which follow referring to quantity should be considered as in the accusative case. Thus, "Recipe, 1 G. or 8 c.cm.," means: "Take one gramme or eight cubic centimetres" of any desired agent. The latter, however, is to be placed in the genitive case whenever the quantity is expressed; thus, "℞ Aquæ calcis, 15 c.cm.," means: "Take 15 c.cm. of lime water." On the other hand, when the quantity is not given in any denomination of weight or volume, the subject itself being directly taken, the latter is put in the accusative case; thus:—

"℞ Vitellum ovi,
Aquæ cinnamomi.....q. s. ad 30 c.cm. or f℥j;

means: "Take the yelk of an egg, and enough cinnamon-water (water of cinnamon) to make thirty c.cm. or one fluidounce," the letters q. s. standing for *quantum sufficiat,* or "as much as may be required to make up the amount specified." If the case-endings are known, the proper cases may be ascertained by trying to insert the word "of"; where this can be done the word following it should be written in the genitive case; thus, in water of cinnamon, or syrup of orange, the words cinnamon and orange will always be in the genitive case. To students unfamiliar with Latin, the difficulties in the way of correct writing of prescriptions may seem insur-

mountable; but they will disappear after a little attention and practice. One of the best ways of learning the genitive case of pharmacopœial nouns is to study the list of fluid extracts or tinctures in which the remedial agent is in the genitive (fluid extract or tinture of —). Familiarity with the names of the Materia Medica will supply the needed information in the majority of drugs regarding the case-endings.

The general form of the prescription is:—

℞ (for recipe, or take)
Basis. of A (in the genitive case), a certain quantity (in the accusative case).
Adjuvant. of B (in the genitive case), a certain quantity (in the accusative case).
Corrigent. of C (in the genitive case), a certain quantity (in the accusative case).
Vehicle. of D (in the genitive case), a certain quantity (in the accusative case).
Pharmaceutical Directions. Let such or such preparation be made.
Directions for the Patient. Write (upon the label) the specific directions for dosage, time of taking, alone or with any vehicle, etc.
Signature. Physician's name.
Date.
Name and Address of Patient. For Mr. So-and-so.

It is not at all necessary that the classical arrangement of base, adjuvant, and so on, should always be observed, but it seems natural to write the most important agent first, and follow this with any agent or agents which we desire to combine with it, and, finally, a menstruum or vehicle if any be needed. For illustration, suppose it is desirable to give a patient an expectorant cough mixture. In order to render the secretions more liquid we may use potassium iodide, or a vegetable substance, like ipecacuanha, and, perhaps, may decide to combine them. Associated with them we may give ammonium chloride, which acts beneficially upon the bronchial mucous membrane, causing the development of more healthy epithelium. Finally, a suitable menstruum would make the mixture more palatable. We next decide upon the quantity for each dose, and the prescription now appears in this form:—

Recipe

Potassii iodidi	20 Gm.	or gr. iij.
Ammonii chloridi	75 Gm.	or gr. xij.
Fluidextracti ipecacuanhæ	12 c.cm.	or *m*ij.
Syrupi sarsaparillæ compositi q. s. ad	7|50 c.cm.	or f3ij.

Misce et fiat mistura.

Or (in English form):—

Take

of iodide of potassium	twenty centigrammes,	or three grains
of ammonium chloride	seventy-five centigrammes,	or twelve grains.
of fluid extract of ipecac	twelve centigrammes,	or two minims.
of compound syrup of sarsaparilla enough to make	7.50 cubic centimeteres,	or two drachms.

Mix. Let a mixture be made.

Having settled that a dessertspoonful (7.50 c.cm., or 2 drachms) will be a sufficient dose to give, we decide upon the number of doses to be ordered. If twenty be the number selected, the entire prescription will then equal twenty times this quantity, or 150 c.cm., and, when completed, will form a mixture, with directions like the following:—

℞

Potassii iodidi	4		Gm. or 3j.
Ammonii chloridi	15	5	Gm. or 3iv.
Fluidextracti ipecacuanhæ	2	50	c.cm. or *m*xl.
Syrupi sarsaparillæ compositi q. s. ad	150		c.cm. or f3v.

Misce et fiat mistura.

Signa: Take a dessertspoonful every four hours for cough, as directed by *Phila., Sept.* 30, 1900.

Dr. X.
For Mr. A.

Another illustration may be taken:—

℞

Base.	Quininæ sulphatis	3		Gm. or gr. xlviij.
Adjuvant.	Acidi sulphurici diluti	4		c.cm. or f3j.
Corrigent.	Tincturæ cardamomi compositæ	26		c.cm. or f3vij.
Vehicle.	Elixir aromatici	90		c.cm. or f℥iij.

Sig.: Take a teaspoonful with water after meals.

Dr. A.
July 20, 1900.
For Mrs. O.

The principal object of the addition of the sulphuric acid is to increase the activity of the quinine by changing it into the more soluble bisulphate. The compound tincture of cardamom makes the mixture more acceptable to the stomach, and increases the tonic effect, in which the alcohol, both of the tincture and the elixir, will participate. Where the latter is objectionable, the syrup of the red orange may be substituted for the elixir.

There is no essential difference, as regards their form, between prescriptions for internal remedies and those for topical or local use; for instance, we may write as follows:—

℞ Olei tiglii	4		c.cm. or f3j.
Olei amygdalæ expressi	7	50	c.cm. or f3ij.

M. Sig.: For external use. Apply with a camel's-hair pencil, once daily, over a space as large as a silver dollar, as directed.

Dr. B.

℞ Acidi gallici	4		Gm. or 3j.
Glycerini	30		c.cm. or f℥j.

M. ft. solutio.

Sig.: Apply, night and morning, to the throat as directed.

Dr. C

℞ Potassi chloratis	8		Gm. or 3ij.
Glycerini	30		c.cm. or f℥j.
Extracti geranii fluidi	15		c.cm. or f3iv.
Aquæ rosæ q. s. ad	180		c.cm. or f℥vj.

M. et ft. mistura.

Sig.: Use as a gargle several times daily, diluting with water if necessary.

Dr. D.

Time and Interval in Relation to Dosage.—In addition to the question of dosage and the proper form in which to administer remedies, the problem of the frequency of giving the dose must be decided; and the time of the day, the relation to meal-time, all come up for settlement. The old and prevailing three times daily, or *ter in die,* method of ordering medicine to be taken arose from the natural division of time and the custom of eating a morning, noon, and evening meal. Remedies affecting the stomach directly are usually given when the organ is empty,—that is, before meals,—while digestive agents, to assist the assimilation of food, would properly be administered during the period of digestion. Systemic remedies, in a similar manner, are best given a short time after meals, so as to mix with the

food and be absorbed with it and so enter the circulation. Laxative pills may be taken after the principal meal of the day (dinner-pills), or, if they contain cathartics of a slowly-acting character, they are best given upon retiring at night, so that in case they cause griping it will not give so much pain or inconvenience as if it occurred during the day. On the other hand, salines, such as Rochelle or Epsom salts, or natural purgative waters containing them, are more efficient when taken early in the morning, when the stomach and intestinal tract are not occupied in digesting food, and are thus more directly affected. It is sometimes of importance that the bowels should be moved just before retiring at night; for instance, where there are hæmorrhoids, it is found that they are liable to come down during the act of defecation, and afterward to cause pain and irritation during the time the patient is in the erect posture. In such a case a laxative, such as compound licorice powder, or rhubarb, may be given at an hour in the afternoon which a little experience will determine so as to bring about the desired result. Narcotic and sedative remedies are more effective if given just before the patient is accustomed to sleep: just as bitter tonics intended to excite the appetite should be given a little before the times appointed for the meals. Remedies may be given for a temporary purpose, as where alum and molasses, or an ipecac mixture, is ordered for croup, or preparations ordered for headache, or cough, which are to be discontinued as the symptoms are relieved or the object of the treatment is accomplished. In treating a patient for tape-worm it is considered advisable to have the intestinal tract nearly empty, and the action of the remedy is greatly assisted by a preliminary purging to carry off the mucus which is thrown out as a result of the irritation caused by the parasite. For the administration of a purgative or the removal of a tape-worm the medicine is frequently taken on Saturday night, so as to enable the patient to rest the following day in case of overaction of the drug. When it is desired to evacuate the stomach by an emetic, it is advisable that some warm water or gruel shall be swallowed, so as to moderately distend the organ and give the muscles something to contract upon. On the other hand, when vomiting is not desirable, as when ipecac is administered for dysentery and it is not intended to be rejected by the stomach, the patient should abstain from drinking water before or after taking the medicine. Seasons and locality have some effects upon dosage: in hot weather the system usually does not bear strong medication as well as in winter-time. In some localities, where malaria is rife, antiperiodics must be given in larger doses, and are required in almost every disease. The numerous modifying elements that arise from circumstance and place, or the condition of particular organs, will receive due attention in another part of this work.

The **Modes of Administration**, from a pharmaceutical standpoint, have already been referred to, but a few words remain to be said from the therapeutical or physiological point of view. Remedies produce systemic effects because they enter the blood and become a part of the circulating fluid, or they may occasionally produce an impression upon the peripheral nerves, and thus produce local or remote effects, owing to reflex action. It must also be admitted that disturbances of function, similar to those produced by medicines, may be produced by emotion or mental states. In certain very sensitive subjects, usually hysterical, it has been found, in Charcot's clinic, that the effects can be apparently obtained by "suggestion," without

administration of the remedy. This is very similar in principle to the metallotherapy of Burq and to the tractotherapy of Perkins. The subject just adverted to will be further discussed in the chapter upon "Hypnotism and Allied States." For the present we are concerned with the actual physiological action of remedies, which may enter the circulation (1) by the mouth and stomach, (2) by the rectum, (3) by the bladder or vagina, (4) by the skin, (5) by the broncho-pulmonary mucous membrane, and (6) by the veins or capillaries upon granulating surfaces.

1. The **mouth** being the natural channel for the introduction of food or sustenance, it seems the most convenient route for the administration of medicines, and is adopted, as a rule. Nature has placed sentinels here in the form of the gustatory nerves and papillæ, and innumerable expedients have been resorted to in order to enable badly-tasting remedies to pass without exciting repugnance or nausea. Patients differ greatly with reference to their ability to take medicines. Some can take castor-oil with a relish, others enjoy asafœtida as a condiment to their food; some are so sensitive that they are nauseated even by the idea of taking medicine of any kind. The latter often tax the resources of the pharmacist and physician, until some more suitable channel is found for introducing the remedy. The absorption of medicines is largely by means of the capillaries or small veins, but the lymphatics or lacteals also participate. After entering the blood the remedies are carried by it into the capillaries of the central nervous system and the various organs of the body. After remaining in the tissues for a greater or less length of time, and exerting certain characteristic effects upon the functions of the several organs, these agents may again enter the circulation, and be excreted from the system by the emunctories. As a rule, the remedy acts as an excitant or stimulant to the organ by which it is separated from the blood. They are subsequently to be found in the various secretions and excretions, either in their original form or some derivative of it. The absorption of insoluble substances is dependent upon their being transformed into soluble form; this may be done by the acid gastric juice or the alkaline intestinal juice. In some cases of ingestion of corrosive poisons the individual may perish from shock, or from spasm of the glottis; but, as the rule, there is sufficient time for absorption of the poison from the alimentary canal before death occurs. When a toxic agent has been swallowed it is important to evacuate the stomach and intestines at once, so as to prevent the continued absorption of the poison.

2. Remedies may be introduced by **enema**,—otherwise called injection, lavement, or clyster. In this instance the mucous membrane of the rectum takes the place of the lining membrane of the stomach. There can be no question with regard to the absorption of remedies by the bowel, since it can be so readily demonstrated. Thus, suppositories of opium produce the usual systemic effects of this drug; quinine, introduced into the rectum, stops intermittent fever; nutritive enemata support life for months, and so on. Injections of starch, with laudanum, are especially useful in painful affections of the rectum or the other pelvic organs, and check secretion in diarrhœa or dysentery. When an enema is to be retained it should not be more than from 1 to 4 ounces, according to circumstances; as a lavement or clyster, as large an amount as can be borne by the patient without causing actual pain may be given,—thus, from 2 to 4 pints may be injected into an adult, from one-eighth to one-fourth this quantity for a child, or 1 or

2 ounces for an infant. The instrument used for this purpose is called a syringe. It may be the classical form, with a piston and receiver, the latter being furnished with a tube, through which the fluid is forced when the piston is forced down. The best are made out of hard rubber; those made of pewter or glass are very inferior. In addition to these, we have the soft-rubber tube, terminating in a tube of metal or of hard rubber; in the course of this tube there is a rubber bulb, which, expanding after compression, exercises suction, and, by alternate compression and expansion, forces fluids along the tube. This is a great improvement over the old style, as it is easily operated and can be used as a self-injecting apparatus. The fountain-syringe is simply a rubber bag or receiver, of adequate capacity, terminating in a tube, through which the water flows by force of gravity, when the reservoir is elevated. A pneumatic syringe is also made, in which the solution is placed and is afterward forced through the tube by pumping air into the bottle, reversing the aspirator of Dieulafoy. The ordinary injection used for evacuating the bowel consists of warm water containing some Castile soap in solution. In addition to this, we may add 30 to 60 c.cm. of castor-oil or a teaspoonful or more of oil of turpentine, in order to make the injection more stimulating. Glycerin may be used for the same purpose, from 4 to 16 c.cm. (1 to 4 drachms) being generally sufficient to evacuate the lower bowel. When **gaseous enemata** are administered, the gas diffuses rapidly into the blood, and is excreted by the lungs. It was thought that the introduction of sulphuretted hydrogen in this way might benefit tubercular lesions in the lungs (Bergeon's method); but it has not been found to be of much service, clinically. Anæsthesia for surgical operations may be produced by the injection of the vapor of ether into the bowel; but this method is not devoid of danger and has not met with much favor.

3. The **bladder** or **vagina** may be used for the administration of remedies; but, usually, agents here applied are only intended to act locally. A weak solution of silver nitrate, or of some sedative antiseptic,—boric acid or carbolic acid,—is sometimes resorted to, with excellent effect, in cases of inflammation; but remedies are rarely, if ever, introduced by either of these channels into the system.

4. The **skin**, or general surface, may be utilized in several ways for the introduction of medicines. In the first place, the agent may be simply applied to the surface and kept in contact with the skin,—the **enepidermic method.** Friction may be called to our assistance to force the agent through the skin,—the **epidermic method.** The cuticle may be removed by a blister or other means, and the agent applied directly to the derma,—the **endermic method.** Remedies may be introduced beneath the skin and thrown into the areolar tissue,—the **hypodermic method.** With regard to the first three but little need be said. There are in use a large variety of lotions and liniments, some of which are active counter-irritants, which are used principally for a local effect. At the same time, remedies can be thus made to produce a systemic effect, as where mercurials are applied by inunction; or quinine is used in the same way. Occasionally, medicines applied to the surface for a local effect may produce a general one, as where a belladonna ointment or plaster produces dilated pupils, or croton-oil causes a general eruption. Similarly, remedies injected under the skin will produce systemic effects. The last-named, or hypodermic, method will require a more extended notice.

By the subcutaneous or hypodermic method, remedies in a state of

solution are introduced by means of a small syringe, armed with a hollow needle, which is made to perforate the skin. This plan was first brought to the notice of the profession by Dr. Alexander Wood, of Edinburgh, and, being adopted, soon acquired a remarkable popularity. It has some decided advantages over ordinary methods, in that it admits of greater precision in dosage, since the entire dose rapidly enters the circulation; whereas, given by the mouth, some may escape absorption. It produces prompt effects, the influence being observed in from five to fifteen minutes, which makes it invaluable in the case of pain. It combines a local with a general effect, as, according to Dr. Wood, the injection should be administered as near to the site of pain as possible. It is clean, it is convenient, and it is cheap because the patient has it given to him. On the other hand, if an overdose be accidentally administered the poisoning must be met by physiological antidotes, since it cannot be withdrawn from the circulation after being injected. If the needle be not strictly sterilized, or aseptic, it may communicate disease, and instances have been known of pyæmia and tetanus following the use of the hypodermic needle. The greatest objection of all is that, by its use, some patients acquire the morphine habit, they are apt to become infatuated with the little instrument and the effects of the punctures, and soon become confirmed morphinomaniacs. It is the latter consideration particularly which has induced physicians to use the hypodermic needle with increasing caution, and to refrain from its use whenever the remedy can be given by the stomach.

The hypodermic syringe is usually made of glass, of 1.30 c.cm. (or twenty minims) capacity, the gradations being engraved upon the barrel or the piston-rod. The needles may be of steel or platinum; if the former they may be gold-plated. Various modifications have been made in the size and shape, but the form used by Dr. Robert Koch, of Berlin, has an advantage, from an antiseptic stand-point, in that it is free from a piston and plunger. The fluid is sucked up by aspiration, by means of a rubber ball attached to the end of the syringe, and, by compression of the ball, is again forced out. The needle is fitted upon the glass barrel by a carefully ground friction-joint, and the whole instrument can readily be taken apart and washed with antiseptic solutions or treated with hot water. The construction of the syringe is readily understood from the foregoing, but a more extended description can be found in the *Medical Bulletin* of February, 1891, by those especially interested in the Koch treatment. There are numerous makes of hypodermic syringes in the market, and those are to be preferred which can most readily be made aseptic and have the smallest needles. Bartholow, who has given much attention to this method, recommends a silver-plated instrument having a flat side to the piston-rod, upon which is marked the quantity of solution contained in the barrel. He makes the proper suggestion that, before using such an instrument, it should be carefully tested with a standard minim-glass, in order to see that it is properly graduated. For convenience of sterilization, hypodermic syringes may now be obtained made entirely of glass. Hypodermic syringes of larger size are also supplied for the special administration of diphtheria antitoxin. The instrument must be kept surgically clean; the needles should be small and sharp, and the syringe frequently washed with antiseptic solution, in order to keep the packing of the piston in good order and prevent it from becoming dry. As regards the solution, it should be chemically pure and made with great accuracy, and

not too concentrated. It should be fresh, because a fungus often develops in the course of a few days (*penicillium*), which destroys the alkaloid. Where the syringe is not frequently used it is better to rely upon extemporaneously prepared solutions made with recently-boiled water, and powders, compressed tablets, or triturates containing the desired quantity. Distilled water that is not fresh is not so good as recently-boiled water for making the solutions. Chloroform-water, orange-flower water, peppermint-water, or carbolic-acid solutions will keep for a comparatively long time without spoiling.

In administering a hypodermic injection, a part of the skin free from superficial veins should be selected and the surface washed with soap and water and made surgically clean. The previously-sterilized needle is introduced in a plane nearly parallel with the surface of the surrounding skin. If, when the needle is in position, the piston be pulled out slightly and blood is seen to flow into the syringe, the needle should be withdrawn and another spot selected. Profound narcotism (possibly fatal coma) might result from the injection of morphine directly into the circulation by puncture of a vein. The place being selected,—generally in the outer aspect of the arm or forearm, or on the back,—the skin is pinched up into a fold between the forefinger and thumb of the operator's left hand. The needle is then introduced lengthwise into the fold, which is slightly elevated as the desired amount is injected; the needle is withdrawn from the little wound by a twisting motion, and the puncture rubbed gently with the finger. A small tumor or swelling is caused by the injection, which is dispersed into the cellular tissue by rubbing. No further attention to the puncture is necessary, although, if it be painful, the next day it may be washed with carbolized water (1 to 128), as a local sedative as well as antiseptic, or a lead-water-and-laudanum compress be applied. The following are frequently employed for hypodermic medication:—

Alcohol	Dose,	60 to 2	c.cm.	or *m*x-xxx.
Æther	"	1 20 to 4	c.cm.	or *m*xx-lx.
Ammoniæ (aqua)	"	60 to 2	c.cm.	or *m*x-xxx.
Apomorphinæ hydrochloridum	"	004	Gm.	or gr. $^1/_{16}$.
Arsenicum (Fowler's Solution)	"	12 to 30	c.cm.	or *m*ii-v.
Acidum carbolicum (liq. phenol.)	"	01 to 13	Gm.	or gr. $^1/_6$-ij.
Amyli nitris	"	20 to 30	c.cm.	or *m*iii-v.
Atropinæ sulphas	"	0005 to 0008	Gm.	or gr. $^1/_{120}$-$^1/_{80}$.
Atropinæ et morphinæ sulphas	"	0004 to 0005	Gm.	or gr. $^1/_{150}$-$^1/_{100}$ atropine.
		0004 to 021	Gm.	or gr. $^1/_{150}$-$^1/_3$ morphine.
Caffeinæ citras	"	065 to 13	Gm.	or gr. i-ij.

℞ Caffeinæ citratis ..... 6|36 Gm. or gr. xcvj.
Glycerini,
Aquæ ..... aa 15| c.cm. or f℥ss.
M. Twelve centigrammes are contained in 0.6 cubic centimetres (ten minims contain two grains).

Cocainæ hydrochloras	Dose.	016 to 065	Gm.	or gr. $^1/_4$-j.

℞ Cocainæ hydrochloridi ..... 75 Gm. or gr. xij.
Aquæ aurantii florum ..... 15| c.cm. or f3iv.
M. Twenty minims contain one grain.

Curare	Dose,	003 to 021	Gm.	or gr. $^1/_{20}$-$^1/_3$.
Coniinæ hydrobromidum	"	0015 to	Gm.	or gr. $^1/_{\ldots}$.
Chloroformum purificatum	"	30 to 1	c.cm.	or *m*v-xv.
or Spiritus chloroformi	"	1 20 to 2 50	c.cm.	or *m*xx-xl.

Chloral ..... Dose, 65 to 1 Gm. or gr. x-xv.
Colchicina ..... " 001 Gm. or gr. $^1/_{60}$.
Duboisinæ sulphas, or hydrobromas..... " 0004 to 001 Gm. or gr. $^1/_{150}$-$^1/_{60}$.
Ergota ..... " 13 to 20 Gm. or gr. ii-iij.

℞ Fluidextracti ergotæ.
Glycerini,
Aquæ.....aa 30 c.cm. or f℥j.

M. Sig.: Use 1.20 to 2.0 c.cm. (or twenty to thirty minims) by injection.

Hyoscina .....Dose, 0006 Gm. or gr. $^1/_{100}$.

℞ Hyoscinæ hydrobromidi..... 012 Gm. or gr. $^1/_5$.
Glycerini ..... 1 20 c.cm. or *m*xx.
Aquæ .....q. s. ad 6 20 c.cm. or *m*c.

M. Sig.: 0.30 c.cm. (or five minims) contains 0.0006 Gm. (or $^1/_{100}$ grain).

Hyoscyaminæ .....Dose, 0006 Gm. or gr. $^1/_{100}$.

℞ Hyoscyaminæ sulphat ..... 03 Gm. or gr. ss.
Aquæ chloroformi ..... 30 c.cm. or f℥j.

M. Sig.: 0.60 c.cm. (or ten minims) constitute a dose (0.0008 Gm., or gr. $^1/_{96}$).

Hydrargyrum (see article "Hydrargyrum," in Part II).
Morphinæ sulphas .....Dose, 01 to 03 Gm. or gr. $^1/_6$-$^1/_2$.

℞ Morphinæ sulphat ..... 50 Gm. or gr. viij.
Phenolis liquefacti ..... 20 Gm. or gr. iij.
Aquæ ..... 30 c.cm. or f℥j.

M. Sig.: 0.60 c.cm. (or ten minims) equal 0.01 Gm. (or gr. $^1/_6$). Powders or capsules may also be used.

℞ Morphinæ sulphatis ..... 25 Gm. or gr. iv.

M. et divide in chartæ vel capsellæ no. xxiv. Each contain 0.01 Gm. (or gr. $^1/_6$). To be used for making an extemporaneous solution.

Quininæ hydrobromidum..... Dose, 065 to 65 Gm. or gr. i-x.

℞ Quininæ hydrobromidi..... 1 50 Gm. or gr. xxiv.
Aquæ destillatæ ..... 30 c.cm. or f℥j.

M. Sig.: 0.60 c.cm. (or ten minims) contains 0.065 Gm. (or one grain) of quinine.

℞ Quininæ sulphovinatis ..... 8 Gm. or gr. cxx.
Aquæ chloroformi ..... 15 c.cm. or f3iv.

M. Sig.: 0.60 c.cm. (or ten minims) contains 0.32 Gm. (or five grains).

The quininæ bimuriata carbamidata, the double chloride of quinine and urea, is soluble in an equal part of water, and is very suitable for hypodermic use.

Scopolamine (same as Hyoscine).
Strychninæ .....Dose, 001 Gm. or gr. $^1/_{60}$.

℞ Strychninæ sulphatis ..... 015 Gm. or gr. $^1/_5$.
Acid. acetic. dil., q. s. ad solve.
Aquæ creosoti .....q. s. ad 15 c.cm. or f3iv.

M. Sig.: 1.20 c.cm. (or twenty minims) contains 0.001 Gm. (or gr. $^1/_{60}$) of strychnine.

Many other instances of eligible forms for the administration of drugs hypodermically will be found, in the following pages, specially mentioned under the drugs concerned.

Parenchymatous injection is a form of hypodermic injection in which the solution is thrown deeply into the tissues instead of merely under the skin. It is employed in cases of neuralgia to deposit the remedies closely

in contact with the affected nerve. Bartholow formerly used chloroform in this way, with marked benefit in cases of sciatica. Bichloride of mercury has been injected into the lung-tissue in the treatment of acute and chronic pneumonitis. Liquefied phenol, or tincture of iodine, has been injected into the cavity of the tunica vaginalis testis in the treatment of hydrocele; and acetic acid and ergot have been thrown into the substance of various new growths. Ether has caused the disappearance of sebaceous tumors when injected into their interior, and parenchymatous injections of cocaine are used as a local anæsthetic for small surgical operations. Insoluble preparations of mercury, like grey oil and calomel, are much used in France, in the treatment of syphilis. The injection is made into the gluteal muscles, and is very slowly absorbed.

5. By **inhalation**, remedies may be introduced, through the route of **bronchial mucous membrane**, into the blood. Although rarely employed, except for producing surgical anæsthesia, this method promises, in the future, to play a more important part in therapeutics. The remedies may be in the gaseous form, as where oxygen or nitrous oxide is administered; they may be in a vapor, and inhaled with steam; or made into a spray with the atomizer, and thus inhaled; or they may be used in fumes, as where tar or asthma pastilles are burnt, or sulphur or mercury vaporized. Concerning the extravagant hopes that have lately been raised (especially in the treatment of pulmonary consumption) of the bactericidal effects of inhalations, the results have not been very favorable. When the smaller bronchial tubes and air-cells and their walls are filled with bacteria the only antiseptic that can reach them is the opsonin contained in the blood and more particularly that contained in the healthy white blood-cell. At the same time salicylic acid and other agents are capable of being introduced into the bronchial tubes, and, by liquefying and favoring the expulsion of the secretions and making them less septic, they are capable of affording much relief to the patient and retarding the progress of the disease, if not hastening the cure. Hay fever is much relieved by applications of cocaine and inhalations of weak solutions of quinine; a similar treatment may sometimes be devised for acute and chronic pulmonary affections. For the production of a fine spray by mechanical action, instruments known as atomizers are used. Hand-atomizers consist of bulbs, which, by compression, deliver a blast of air through a tube past a capillary orifice in another tube, the latter being partially immersed in water or other desired solution. The blast of air produces a partial vacuum, and the fluid ascends the tube until, escaping by drops, it is blown into fine spray at right angles to the extremity of the tube. This is a very convenient instrument for small quantities of medicated solutions. When the quantity is larger the hand would become tired, and steam may be resorted to, or we may use compressed air by means of an air-pump. Some very neat and even ornamental forms of the latter have been devised by ingenious instrument-makers, and they may now be met with in the offices of all physicians who pay special attention to treatment of diseases of the throat or lungs.

6. The **intravenous administration** of medicine is the most direct method at our command of obtaining prompt physiological effects from our remedies. The transfusion of blood is an ancient therapeutic device, and it naturally suggested the employment of remedies in the same manner. In the collapse of cholera, intravenous saline injections have saved numerous

lives that were apparently in a hopeless condition. The formula adopted by Hayem is:—

Sodium sulphate	25	Gm.	or gr. 390.
Sodium chloride	5 30	Gm.	or gr. 80.
Sodium hydrate	1	Gm.	or gr. $15^1/_2$.
Water	90	c.cm.	or fld. oz. 3.

This should be filtered and brought to the temperature of the blood at the surface, or not more than 100° F. Of such a solution as much as 2 quarts have been used at one operation, but, as a rule, 1 quart will be quite sufficient. It is important to inject the fluid slowly, so as to imitate the natural blood-current. Solutions of sodium phosphate and chloride (specific gravity about 1020) have also been employed with success. The late Dr. Fagge employed the latter solution in the treatment of diabetic coma with remarkable improvement after 26 ounces (imperial) had been thus used. In cases of collapse from hæmorrhage, milk has been employed by a number of operators, with gratifying results. Halford, of Australia, has shown that, after a wound from a venomous snake, the intravenous injection of aqua ammoniæ fortior (1 part) with aqua destillata (2 parts) is well borne and aids the system in sustaining itself under the effects of the poison, although it may not be directly antidotal, as was at first supposed. J. T. Eskridge used undiluted aqua ammoniæ fortior, injected into the vein of the arm, without bad consequences and with recovery of the patient, who had been asphyxiated with hydrogen sulphide. It is also of service in thrombosis of the pulmonary artery, chloroform asphyxia, hydrocyanic poisoning, etc. The danger of admitting air into the vein is not very great and its evil consequences have been greatly exaggerated; however, it may readily be averted with a little care. It is hardly necessary to add that the lancet, and, in fact, all of the instruments should be surgically clean, and that every antiseptic precaution should be scrupulously observed.

Transfusion of blood has been performed many times, and various modifications of instruments have been invented to accomplish it. The trouble is that, when the emergency arises, the instruments are not at hand, except in a large general hospital, and the practitioner must extemporize a transfusion apparatus out of a 4- or 6-ounce syringe and a rubber and glass tubes. **Immediate transfusion** is where the blood flows from the donor's blood-vessel into the recipient's, through a tube which had been previously filled with an antiseptic solution. A syringe may be introduced, so as to measure the amount of blood, as in the instrument of Martin, of Berlin. The instrument of Aveling, of London, is simply a rubber tube with a bulbous enlargement in the middle. The capacity of the bulb is 2 drachms. Silver cannulas are placed at the ends of the tube, which is about fifteen inches in length. Each cannula is guarded by a stop-cock, and the ends are beveled or rounded, so as to facilitate the insertion. The mode of operation is to carefully cleanse the apparatus by immersion in warm, recently boiled water. The air is entirely expelled, and a warm saline solution used to completely fill the tube. The veins of the donor and recipient being selected,—generally in front of the elbow,—the incision is made with a scalpel and a tube inserted into each, and held in place by the fingers of an assistant in preference to a ligature. Now, the stop-cocks being turned, the tube is

pinched on the side toward the donor, and the fluid is forced onward; the efferent tube is then pinched, and the bulb allowed to slowly refill, when it is again emptied and again refilled, until the proper quantity of blood (6 to 8 ounces usually) has been delivered. The apparatus is then withdrawn, a ligature placed upon the veins, and a proper dressing applied.

In **mediate transfusion** the blood is drawn into a warm bowl, beaten or whipped with sterilized straw to remove the fibrin and prevent subsequent clotting; then the blood is taken up into a previously warmed syringe and slowly injected, through a cannula, into the vein, the median basilic generally being chosen for the purpose. In this way repeated charges may be slowly and gently delivered, but, as Bartholow taught, from 4 to 8 ounces of blood will usually be sufficient to strengthen the heart and avert threatened collapse. The use of lambs' blood was advocated by Gesellius and others, but the transfusion was generally followed by a rigor and sweating, which greatly prostrated the patient, and it is no longer practiced.

Transfusion has been performed in phthisis and other chronic diseases without benefit. It is of greatest service in acute emergencies, such as severe hæmorrhage (traumatic or post-partum), hæmatemesis, intestinal hæmorrhage, epistaxis, etc. In the hæmorrhagic diathesis it has been successfully used by Dr. Buchser, of New York, but it has failed in simple anæmia. In acute poisoning by phosphorus, or carbonic oxide, transfusion has been resorted to successfully by a number of clinicians. A modification of this method has been proposed by Albanese and Hueter in **arterial transfusion.** In this method an artery of one of the extremities is selected and divided (generally the radial or posterior tibial being taken), and the blood is injected just as in mediate transfusion. The advantage sought for is the prevention of clotting and the danger of embolism, and that there is less danger of the introduction of air. Where a large quantity is to be injected, it might be better to employ this expedient, so as to avoid any danger of suddenly overwhelming a weak heart. The effects following the **transfusion of milk** have been found to be very much the same as those from the use of blood, except that albuminuria is more apt to follow. When milk is used it should be taken directly from the cow or goat, and after being carefully strained, without being allowed to cool, it should be gradually introduced into the circulation by means of the syringe and cannula. The results, in some cases, of the treatment after hæmmorrhage have been to warrant further trial. At the same time, the report of those who have gone over the entire subject critically is that nothing can be a complete substitute for human blood for the purpose of transfusion. The later plan of injecting a quantity of blood into a large serous sac like the peritoneum, as recommended by Ponfick, has found few followers, and, whereas some good results have been reported, others have occurred in which death resulted from peritonitis.

The introduction of large quantities of water or of normal salt solution into the peritoneal cavity or under the skin has been followed by excellent results in the collapse of cholera and after hæmorrhage. It will be considered fully under the title "Hypodermoclysis."

Medicines may be applied **topically** to wounds and granulating surfaces, or injected into suppurating cavities. The fact that such agents may be absorbed and produce systemic poisoning should lead us to be careful in applying carbolic acid, corrosive sublimate, or other active antiseptics which have powerful toxic effects upon the human organism. By what is called

galvanic cataphoresis medical solutions may be made to pass through the skin, and directly into the tissues and the blood (see **Electrotherapeutics**).

Idiosyncrasy: Individual Peculiarities Affecting the Dosage or Mode of Administration of Drugs.—Personal peculiarities on the part of the patient, as regards the effects of remedies, often cause serious embarrassment to the prescriber. They are usually attributed to **idiosyncrasy**; but this is merely a term wherewith to hide our ignorance of the real cause. One of the puzzles of experimental therapeutics is the occasional contrast in the action of remedial agents in different species of animals,—*e.g.*, pigeons are very slightly affected by opium and are not injured by a quantity which would be fatal in man; a deer can eat tobacco, or a rabbit belladonna-leaves, without producing toxic effects. Something of a similar character occurs among patients. It is simply impossible to anæsthetize some patients with ether, and we are obliged, in such cases, to resort to chloroform when a surgical operation is required. There is also a great difference with regard to susceptibility to the effects of alcohol; some persons are easily overcome by it, and quickly rendered helpless and unconscious; others can take very large amounts, and, while showing its physiological effects by inebriety, are not discommoded by it to the extent of losing control of themselves. Sometimes we encounter individuals who are rendered very uncomfortable by calomel, even a small dose bringing on neuralgia or gouty pains in the joints; others require quite large doses to produce any effects at all. Cinchona and its alkaloids (quinine, cinchonine, quinidine, etc.) sometimes cause disturbance of digestion and eruptions upon the skin, even purpura hæmorrhagica, cases of the latter having been reported by Dr. Woodbury.[1] The objections to taking quinine sometimes encountered, however, are probably due to ignorantly confounding it with other agents, such as mercury. Some patients cannot take colchicum at all; others can use it in large doses with good results. Opium and its alkaloids, morphine especially, are often productive of unpleasant consequences; and, instead of soothing a patient and producing sleep, they occasion excitement, restlessness, headache, irritation of the skin (followed by vomiting and prostration), or an eruption resembling urticaria or erythema. In the same way, potassium iodide, even in small doses, occasions severe coryza in some patients, while in others a vesicular or bullous eruption appears, resembling varicella or variola. Unexpected prostration and symptoms of poisoning have occasionally followed the administration of ordinary doses of chloral-hydrate, the cases terminating fatally, in spite of everything that could be done. This occurs so frequently from chloroform that its use as an anæsthetic has been abandoned by many surgeons, or employed only with great caution. Iodoform, as a surgical dressing, even, may cause poisoning in certain susceptible persons. The new aromatic compounds—antipyrin, acetanilide, sulphonal, etc.—occasionally excite a peculiar train of toxic effects, for which, as yet, no explanation, except idiosyncrasy, has been given. On the other hand, it is sometimes necessary to give large doses of quinine, opium, calomel, chloral, or potassium iodide, in order to produce a desired, or positive, therapeutic result. When such unpleasant effects forbid the employment of a remedy, it becomes necessary to resort to a substitute, or **succedaneum**, as it is called, having

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[1] *Philadelphia Medical Times*, Sept. 18, 1886.

similar therapeutic effects without the objectionable features of the former agent.

From all that has been said in the preceding pages, the explanation is easily given of the reason why the dose of a drug cannot be stated with the same definiteness as its specific gravity, for instance. While we can say that a certain quantity is a customary or usual dose, and that a larger quantity is the maximum dose, which, under ordinary circumstances, it is not well to exceed, at the same time we may find patients who cannot take even the ordinary dose without great discomfort, and others who actually require extraordinarily large doses before obtaining the anticipated therapeutic result. The Committee on Revision has introduced the average or medium therapeutic doses into the Pharmacopœia; but has very wisely avoided the question of maximum dosage. It is customary, when a very large dose is stipulated in a prescription, for the pharmacist to ascertain from the physician if the dose was intended, or was due to a mistake, owing to haste or to interruption while writing it. Physicians can save delay, in a case where a large dose is intentional, by underlining it or putting a star after it, to indicate that notice has already been taken by the author of the prescription, and it is not necessary to call it to his attention again.

Prescribing for Children.—If the doses for adults are subject to such fluctuation and uncertainty, it is evident that any calculation by mathematical formula of the dose for a child at any given age, based upon the adult dose, must be unreliable. Several such schemes have been proposed. Thus, Dr. Young's plan was to diminish the dose in the proportion of a fraction whose numerator is a figure representing the child's age and the denominator the age of the child increased by 12. The rule would therefore be: Multiply the adult dose by a figure corresponding to the years of a child's age and divide by the age plus twelve. Thus, if a child's age is 6 years and the adult dose 20 grains, we have the following formula:—

$$20 \times \frac{6}{6+12} \text{ or } \frac{1}{3} = 6\tfrac{2}{3} \text{ grains.}$$

The fact that the development of children depends upon other factors than age is sufficient to show the fallacy of this scheme, especially if we remember that some children, like adults, are very susceptible to medicines. A somewhat more rational plan than the preceding is based upon the weight of the child, which is taken as the numerator of a fraction whose denominator is 140, which is arbitrarily taken as the average adult weight. Inasmuch as many circumstances besides the age and weight of an individual affect the question of dosage, and as this is even more evident in prescribing for children than among adults, we cannot advocate any such mathematical formulæ for ascertaining the dose for children. Caution should be observed in prescribing narcotics to very young children; a single drop of laudanum has caused the death of an infant, while, on the other hand, they may bear, without injury, relatively large doses of belladonna, conium, arsenic, and of mercury. Ptyalism should never be intentionally set up in children by an excessive use of mercury, because it may be followed by inflammation and sloughing of the lips and cheek and other serious lesions. In writing a prescription for a child it is sometimes of advantage for the pharmacist to know the fact, which may be indicated by addressing it "for baby," or "for Willie or Mary," or simply "for Mr. Blank's child."

In concluding this part of the work, the following table will be found useful in reading and writing prescriptions:—

Latin Terms and Phrases Employed in Prescriptions.

WORD OR PHRASE.	USUAL CONTRACTION.	ENGLISH EQUIVALENT.
A *or* Ab (prep. with ablative)	A *or* Ab	From *or* Out of.
Ad (with accusative)	Ad	To *or* Up to.
Adde	Add	Add.
Ad duas vices	Ad 2 vic.	In two takings *or* doses.
Ad tertiam vicem	Ad 3 vic.	At three takings *or* doses.
Ad libitum	Ad lib.	At pleasure.
Absente febre	Abs. feb.	Fever being absent.
Adstante febre	Ad. feb.	Fever being present.
Adhibendus	Adhib.	To be administered.
Admove	Admov.	Apply.
Aliquot	Aliquot	Several.
Alternis horis	Alt. horis	Every second hour.
Alvo adstricta	Alv. adstrict.	The bowels being bound.
Ana	aa *or* aa.	Of each.
Ante cibum	Ante cib.	Before food.
Aqua astricta	Aq. astr.	Ice.
Aqua bulliens	Aq. bull.	Boiling water.
Aqua destillata	Aq. dest.	Distilled water.
Aqua ex flumine	Aq. ex flum.	River water.
Aqua fervens	Aq. ferv.	Hot water.
Aqua fluvialis	Aq. fluv.	River water.
Aqua fontis *or* fontana	Aq. font.	Spring water.
Aqua pluvialis	Aq. pluv.	Rain water.
Aqua pura	Aq. pur.	Pure water.
Bene	Bene	Well.
Bis in die	Bis die *or* Bisind.	Twice daily.
Bougia	Boug.	A long suppository *or* Bougie.
Bulliat	Bull.	Let it boil.
Capiat	Cap.	Take.
Caute	Caute	Cautiously.
Cibus	Cib.	Food *or* Meal-time.
Cochleare magnum	Coch. mag.	A tablespoonful.
Cochleare medium	Coch. med.	A dessertspoonful.
Cochleare parvum	Coch. parv.	A teaspoonful.
Cola *or* Coletur	Col. *or* Colet.	Strain.
Collyrium	Collyr.	An eye-wash.
Coloretur	Coloret.	Let it be colored.
Compositus	Co. *or* Comp.	Compound.
Congius	Cong.	A gallon.
Continuantur remedia	Cont. rem.	Continue the medicine.
Coque, Coquantur	Coq.	Boil.
Cras, Crastinus	Crast.	To-morrow.
Cras mane sumendus	Cras mane sum.	Take to-morrow morning.
Cujus	Cuj.	Of which, of any.
Cujus libet	Cuj. lib.	Of any you please.
Cum (with ablative)	Cum	With.
Cyathus	C. *or* Cyath.	A glass.
Cyathus vinarius	C. vin.	A wine-glass.
Debita spissitudo	Deb. spiss.	Proper consistence.
Decubitus	Decub.	Lying down (*or* A bed-sore.)
De die in diem	De d. in di.	From day to day.
Diebus alternis	Dieb. alt.	Every second day.
Diebus tertius	Dieb. tert.	Every third day.
Dilue, Dilutus	Dil.	Dilute, diluted.

WORD OR PHRASE.	USUAL CONTRACTION.	ENGLISH EQUIVALENT.
Dimidius	Dim.	One half.
Divide	Div.	Divide.
Dividatur in partes æquales	Div. in par. æq.	Let it be divided into equal portions.
Donec alvus soluta fuerit	Donc alv. sol. ft.	Until bowels are open.
Dosis	D.	Dose.
Drachma	Dr. *or* ʒ	A drachm.
Durante dolore	Dur. dolor.	During pain.
Eadem	Ead.	The same.
Ejusdem	Ejusd.	Of the same.
E *or* Ex	E.	Out of, from.
Fac *or* Fiat	F. *or* ft.	Make, *or* let be made.
Fac pilulas duodecim	F. pil. xij.	Make 12 pills.
Fervius	Ferv.	Hot.
Fiant chartulæ duodecim	Ft. chart. xij.	Let 12 papers be made.
Fiant pilulæ duodecim	Ft. pil. xij.	Let 12 pills be made.
Fiat emplastrum	Ft. empl.	Let a plaster be made.
Gargarisma	Garg.	A gargle.
Gradatim	Grad.	By degrees.
Gutta, Guttæ	Gtt.	Drop *or* Drops.
Guttatim	Guttat.	By drops.
Haustus	Haust.	Draught *or* Potion.
Horâ decubitus	Hor. Decub.	Bed-hour.
Horâ somni	Hor. som.	Hour of sleeping.
Horæ unius spatio	Hor. 1 spat.	One hour's time.
Idem	Id.	The same.
In dies	Ind.	Daily.
Infrico	Infr.	To rub in.
Infusa	Inf.	Let it infuse *or* steep.
Intime	Int.	Thoroughly.
Jus	Jus.	A broth (juice).
Linimentum	Lin.	A liniment.
Lotio	Lot.	A lotion.
Macero	Mac.	To macerate.
Magnus	Mag.	Large.
Mane	Mane	In the morning.
Mane primo	Man. prim.	First thing in the morning.
Medicamentum	Med.	A medicine.
Mica panis	Mic. pan.	Crumb of bread.
Minimum	M. *or* Min.	A minim.
Misce	M.	Mix.
Mitte	Mitt.	Send.
Mitte decem tales	Mitt. x tal.	Send 10 such.
Modicus	Mod.	Moderate-sized.
Modo præscripto	Mod. præsc.	In the manner written.
Mollis	Moll.	Soft.
Morbus	Morb.	A sickness.
More dictu	Mor. dict.	In the manner directed.
More solito	Mor. sol.	As accustomed.
Ne tradas sine nummo	Ne tr. s. num.	Collect on delivery.
Nocte maneque	Noct. maneq.	Night and morning.
Nomen proprium	Nom. prop.	The proper name.
Non repetatur	Non repetat.	Let it not be repeated.
Octarius	O., Oct.	A pint.
Omni horâ (*or* Omnis horis)	Omn. hor.	Every hour.
Omnibus alternis horis	Om. alt. hor.	Every second hour.
Omni bihoris	Om. bih.	Every two hours.
Omni quadrante horæ	Om. ¼ h.	Every fifteen minutes.
Omni mane vel nocte	Om. mane vel noc.	Every morning or night.
Optimus	Opt.	Best.
Partes æquales	P. æq.	Equal parts.
Parvulus	Parv.	Small.

WORD OR PHRASE.	USUAL CONTRACTION.	ENGLISH EQUIVALENT.
Penicillum camelinum	Penicil cam.	Camel-hair pencil.
Per (accusative case)	Per	Through *or* By.
Phiala prius agitata	P. p. a.	The bottle being first shaken.
Post (accusative)	Post	After.
Pro (ablative)	Pro	For *or* According to.
Pro ratione ætas	Pro rat. æt.	According to patient's age.
Pro re nata	P. r. n.	As occasion arises.
Quantum libet	Q. lib.	As much as pleases.
Quantum sufficiat	Q. suff.	As much as suffices.
Quâque horâ	Qq. hor.	Every hour.
Quoque	Quoq. *or* Q.	Also.
Quotidie	Quotid.	Daily.
Recipe	℞	Take.
Redactus in pulverem	Red. in pulv.	Powdered.
Repetatur	Repetat.	To be repeated.
Scrupulum	Scrup. *or* ℈	A scruple (20 grains).
Secundum artem	Sec. a.	According to art.
Semi *or* Semisse	Ss.	A half.
Semihora	Semih.	Half an hour.
Sesqui	Sesqui.	One and a half.
Signa	Sig.	Write.
Simul	Simul	Together.
Sine	Sin.	Without.
Singulorum	Sing.	Of each.
Si opus sit	Si op. sit	If need exists.
Solve	Solv.	Dissolve.
Statim	Stat.	Immediately.
Stet *or* Stent	St.	Let it (or them) stand.
Subinde	Subind.	Frequently.
Succus	Suc.	Juice.
Sumat talem	Sum. tal.	Take one such.
Sume	Sum.	Take.
Talis	Tal.	Of such.
Tere	Tere	Rub.
Ter in die	T. i. d.	Thrice daily.
Tritura	Trit.	Triturate *or* Grind.
Tussis	Tus.	Cough.
Ultimus Præscriptus	Ult. præsc.	The last ordered.
Ut dictum	Ut dict.	As directed.
Vel	Vel	Or.
Verus	Ver.	Genuine.
Vesper	Vesp.	The evening.
Vitellus	Vitel.	Yelk of an egg.

POISONS AND ANTIDOTES.

A general formula for administration in cases of poisoning by an unknown agent is sometimes useful as a sort of universal antidote. Dr. Murrell recommends the following combination:—

℞ Liquor ferri sulphatis (ad saturandum)	100
Aquæ	800
Magnesiæ	88
Carbonis animalis purificatæ	40

The iron solution is to be kept separate from the mixture of calcined magnesia and animal charcoal until wanted, and then the ingredients should be put in a bottle and well shaken together. The solution should be drunk

while the insoluble ingredients are in a state of suspension. A wineglassful at a dose, frequently repeated.

The following table is placed here for convenience of reference; for further details of treatment the reader is referred[1] to the paragraphs relating to toxic effects and antidotes under the individual titles in the section devoted to drugs.

Poisons.	*Treatment.*
Acetanilide, Antipyrin.	Diffusible stimulants, hot alcoholic drinks, hot coffee, stimulating enemata, hypodermic injections of atropine, digitalis, or nitroglycerin.
Acids:— Acetic, Hydrochloric, Nitric, Oxalic, Phosphoric, Sulphuric, Tartaric.	Magnesia, chalk, dilute solutions of alkaline carbonates (soap, tooth powder). Demulcents: milk, albumin, oils. (For hydrocyanic acid the treatment is the same as for cyanide of potassium.)
Alkalies:— Caustic potash, Concentrated lye, Soda, Lime, Ammonia, etc.	Vinegar, dilute acids, lemon-juice. Demulcents: milk and oil, flour and water, etc. Opium, morphine, and atropine to relieve symptoms.
Alkaloids.	Finely divided animal charcoal, tannic acid, coffee.
Poisonous vapors and gases: Ammonia, Bromine, Chlorine, Iodine, Carbonic oxide (CO), Carbon dioxide (CO_2), Charcoal-fumes, Coal-gas, Fire-damp, Choke-damp, Marsh-gas, Hydrogen sulphide.	Fresh air, oxygen inhalations, artificial respiration. Intravenous injections of ammonia. Transfusion of blood.
Aconite.	Diffusible stimulants, tannic acid, coffee or tea infusion, alcohol, ammonia. Hypodermic injections of digitalis, strophanthus, atropine, or amyl nitrite. Hot pack. Faradization.
Alcohol.	Coffee, ammonium acetate, strychnine, stimulating enemata, catheterization, stomach-pump.
Anæsthetics.	Artificial respiration, inhalation of ammonia or amyl nitrite, faradization, inversion of the body.
Antimony.	Tannic acid, albumin, milk, and demulcents, with hypodermic injections of morphine and atropine.

[1] For further information concerning poisons and their antidotes the reader will consult the individual drugs in Part II. He also will find Dr. Murrell's little book, "What to Do in Case of Poisoning," very convenient for reference.

Apomorphine.	Chloroform mixture; digitalis hypodermically. Diluents and stimulants.
Arsenic.	Freshly-precipitated hydrated sesquioxide of iron, ferric hydrate in a moist and pulpy state (a tablespoonful to each grain of poison), or hydrated oxide of iron with magnesia, or dialyzed iron. Animal charcoal, magnesia levis, with opium to relieve pain and vomiting or diarrhœa. Demulcents.
Atropine. (Belladonna).	Fixed alkalies. Caffeine, or fresh infusion of coffee or tea, artificial respiration. Morphine, cautiously given, physostigmine, muscarine, and pilocarpine are physiological antidotes.
Belladonna.	(See atropine.)
Brucine.	Same as for strychnine.
Calabar bean. (Physostigmine).	Stimulants, fixed alkalies, atropine hypodermically, artificial respiration.
Cannabis Indica.	Atropine.
Cantharides.	Opium, demulcent drinks, saline cathartics. Avoid oils and fats.
Carbolic acid.	Soluble sulphates, saccharated lime, stimulants and anodynes. Alcohol. Glycerin.
Chloral.	Hot infusion of tea or coffee, strychnine hypodermically, warmth and exercise.
Cinchona (Quinine. Cinchonine, Quinidine, etc.).	Tannic-acid and astringent infusions: iodine forms insoluble compounds with the alkaloids. Morphine and atropine hypodermically.
Codeine.	(See opium.)
Colchicum.	Opium, stimulants, astringents.
Conium.	Alkalies, astringents, strychnine hypodermically.
Copper.	Morphine, albumin, demulcents.
Corrosive sublimate.	Albumin, atropine, and morphine.
Croton-oil.	Opium, stimulants, astringents.
Curare.	Strychnine and atropine, oxygen inhalations, artificial respiration.
Cyanide of potassium. (Hydrocyanic acid).	Artificial respiration, ammonia inhalations. Cold affusions to the spine, transfusion of blood. Ether hypodermically.

Digitalis.	Opium, nitroglycerin solution.
Gelsemium.	Atropine, strophanthus, hot alcoholic stimulants, hypodermic injections of ether.
Lead salts.	Magnesium sulphate, opium, potassium iodide. Baths.
Lobelia.	Morphine, strychnine, strophanthus, stimulants.
Mercurials.	(See also corrosive sublimate.) Albumin, demulcent drinks, opium or belladonna.
Muscarine (Mushrooms).	Stimulants and cathartic agents, atropine hypodermically, with morphine, if needed.
Nitrites:— Amyl, Sodium, Nitroglycerin.	Stimulants, digitalis, atropine, artificial respiration, hot and cold douches, ergot.
Opium (Morphine, Codeine).	Emetics or stomach-pump, coffee, exercise, friction or flagellation, caffeine by the rectum, atropine hypodermically, faradization, artificial respiration, warmth, permanganate of potassium.
Phosphorus.	Old oil of turpentine; sulphate of copper. Avoid oils and fats. Transfusion of blood.
Picrotoxin.	Chloral, bromides, morphine.
Pilocarpine.	Atropine and morphine hypodermically, stimulants.
Savin.	Soluble sulphates, demulcents, anodynes.
Silver nitrate (Lunar caustic).	Table-salt, chlorides, demulcents, potassium iodide.
Snake-venom.	Ligature of limb, with application of cupping glass or caustic alkali. Ammonia inhalation, stimulants. Artificial respiration. Heat to surface. Solution of potassium permanganate injected into the wounds. Digitalis or ammonia hypodermically.
Strychnine.	Chloral, potassium bromide, chloroform by inhalation, alkalies, tannin, alcoholic stimulants.
Tobacco.	Strophanthus, hot applications, and cardiac stimulants; strychnine hypodermically.
Turpentine, oil of.	Magnesium sulphate, demulcents, opium.
Veratrine.	Diffusible stimulants, caffeine; rest in recumbent posture.
Zinc salts.	Sodium carbonate and demulcents; anodynes if needed.

GENERAL THERAPEUTICS.

Therapeutics is the application of knowledge to the treatment of the sick. It comprises in its widest scope everything relating to the prevention, cure, or alleviation of disease. The special pharmaceutical agents employed in the treatment of sickness in the human subject, taken in the aggregate, constitute the Materia Medica. Among these are many inorganic elements and their compounds; but by far the larger proportion is made up of organic substances, especially certain vegetable structures. These crude drugs and their derivatives form the principal part of the various classes of official pharmaceutical preparations. A smaller portion is supplied by animal bodies, such as the organic extracts, antitoxins, digestive ferments, etc.

The drugs and preparations which constitute the United States Pharmacopœia are, in this country, spoken of as official. All other remedies are unofficial. In the following pages the remedies of the British Pharmacopœia are also systematically considered, but these are only official where the British standard authority governs. The official remedies represent a select class of therapeutic agents, the value of which has been established by careful investigation and clinical experience. The results of the excellent work of the Committee on Revision of the United States Pharmacopœia deserve high appreciation.

The Materia Medica does not represent the sum-total of the resources of modern medicine. In addition to his knowledge of the action of drugs the physician must understand the value of hygienic measures, which add greatly to the comfort of the patient and facilitate his recovery. The human body is an assemblage of organs designed collectively as an apparatus for the transformation and evolution of energy. The activity of the vital forces gives the living body recuperative power which, when properly directed, tends to restore disturbed functions to their normal conditions. A knowledge of physiology often enables the physician to anticipate Nature's methods and to place the patient under circumstances most favorable for his recovery.

Modern therapeutics is not based upon mere theory, but upon a scientific foundation of physiologic experiment and clinical experience. Pharmacology is affiliated with the other natural sciences, and its facts, which are determined by true scientific methods, are capable of demonstration in the laboratory and clinically. They also agree with the general experience of mankind. In his early struggles for existence man learned by accident the medicinal qualities of mineral springs and some vegetable substances. In the course of centuries the effects of these drugs became thoroughly established by experience, and their application to bodily disorders was better defined. It is to be noted that these actions of drugs upon the human body and its functions are elementary facts and are essential characters of the substances in question. They are supported by the same character of evidence as the statement that sugar tastes sweet or quinine bitter. They are true biochemical phenomena or physiologic reactions.

The influence of the mind upon the body, especially during the play of strong emotions or of subconscious attention, is fully recognized, by pathologists and clinical observers, as a cause of disordered function, such as aphonia, paralysis of sensation or motion, and various neuroses. It has

been shown by experience that, frequently, such cases may be cured by suggestion, or by simply acting on the mind of the patient. The practical lesson to be learned is that the mind is a powerful factor in causing or intensifying disturbances of the body, and, on the other hand, is a very valuable adjunct in therapeutics. The eminent Dr. Rush appreciated this so highly that he always, when giving a remedy to a patient, took particular care to impress upon the individual's mind the effects which he expected to follow its administration. This practice is now followed by many, who are acknowledged to be the most successful exponents of modern medical science.

It has often been observed that among patients of highly developed nervous organization the administration of some almost inert remedy, or even the use of some mysterious agent (such as Perkins's tractors, Haygarth's imitation tractors, the iron ring for rheumatism, the horse-chestnut or potato carried in the pocket for other disorders, amber necklaces for fits, etc.) may be followed by apparently marvelous results. The eminent American surgeon, Joseph Pancoast, in lecturing to his class, pointed out that some patients suffered discomfort or disease, without having any bodily disorder; but he insisted upon the clinical fact that, whether a man be sick in his body or in his mind, he is sick, and appropriate treatment should be administered, physics for the bodily sick; psycho-therapy for the mentally disturbed.

There can be no success in therapeutics without recognizing the importance of the psychical factor in disease. Sometimes a sudden mental shock will restore speech to an aphonic patient, or it may be expectant attention alone that accomplishes the result. Sir Humphry Davy reported an interesting case of a paralytic patient, who remarked, after experiencing the novel sensation of having a clinical thermometer placed under his tongue, that he felt better. Upon repeating the procedure daily he steadily improved, and fully recovered at the end of a fortnight without any other treatment.[1] Patients of neurotic ancestry, without being actually insane, often have delusions, or morbid fears, about their health. In such cases, what is called the moral treatment is of the highest importance. In order to obtain the best results in therapeutics, it is essential that the physician shall use every proper means to secure the confidence and co-operation of the patient. Expectant attention is acknowleged to be a powerful therapeutic adjunct. Suggestion undoubtedly has a strong influence, and is a factor in therapeutics to be reckoned with.

Disease is frequently caused or maintained by certain states of the blood.[2] These may be provisionally divided into three classes. 1. Those in which there is a diminution or absence of certain principles in the blood which are necessary for cell-development and metabolism. Thus, a peculiar morbid condition (cachexia strumipriva) has been observed to follow removal, or destruction by disease, of the thyroid gland, apparently because the blood is deprived of some important constituent or internal secretion which this gland elaborates and which is necessary to health. This con-

[1] "On Superstitions Connected with the History and Practice of Medicine and Surgery." By Thomas Joseph Pettigrew, Philadelphia, 1844.

[2] Abstracted from an address on "Our Therapeutics," delivered by the author before the Ohio State Medical Society. *Journal of the American Medical Association*, June 3, 1899.

dition has been shown to be amenable to treatment by means of thyroid extract obtained from the organs of sheep. When we treat anæmia with iron, rickets with lime-salts, scurvy with lemon-juice, or neurasthenia with hypophosphites, this principle is followed of supplying to the blood certain proximate principles which are needed for healthy metabolism. Similarly, we may supply some substance which the blood needs to enable it to resist infection or throw off the consequences of infection. Thus, antitoxin is used in diphtheria and similar bodies in erysipelas, tetanus, typhoid fever, plague, pneumonia, tuberculosis, cholera, and yellow fever. 2. There is another class of cases in which certain elements normally present in the blood are in such excess as to cause symptoms of disorder. In diabetes, for example, there is an excess of glucose in the blood, and the result is manifested in glycosuria. In gout and lithæmia, we have evidence of excess of uric acid, or of other compounds of the xanthin group. In jaundice there is biliary pigment in the circulating fluid. The object of treatment in such cases is to diminish the quantity of the pathogenic element by administering drugs which reduce production and augment excretion, thus placing the patient in a condition approaching the normal. 3. In a third class, there are present in the blood substances which are not among its ordinary constituents and which cause disturbance of cell-action (alcohol, nicotine, muscarine, metallic poisons, etc.). There is a large class of substances of bacterial origin which cause symptoms of disease when introduced into the blood. In addition to the group of infectious diseases, which are familiar instances, there are also toxins absorbed from the alimentary tract and productive of symptoms, the origin of which is often overlooked. Thus, eczema may be produced in this manner. A case has been reported in which, after the removal of a Fallopian tube, which was distended with pus, a lupus of the face underwent a spontaneous cure. Albuminuria is likewise occasionally due to toxins. In all these instances it is seen that when the active cause of the disease is recognized and removed the symptoms will disappear. How drugs may be utilized in bringing about this result it will be the object of therapeutics to show, as will be made manifest in the following sections on the uses of drugs.

Therapeutic Classification of Remedies.

Classification has been found as difficult in Materia Medica as in every other branch of natural science. It is impossible to mark out, with exactitude, definite limits to the action of drugs on account of the fact that they often simultaneously influence different organs and functions. If, from one point of view, a medicine be described as a diuretic, from another standpoint it might be no less properly placed among the carthartics or diaphoretics. When we seek to understand the mechanism of its action and its influence upon the composition of the urine, we must also study its effect upon the central nervous system, the cardiac nerves and ganglia, the heart-muscle, and the muscular coat of the arterial system. The organs concerned in sanguification may likewise be affected, and this result is evidenced by the changed proportion of the urinary constituents. If a drug specially impresses the chief nerve-centres, its range of influence must extend more or less powerfully and directly to every important organ. It need not, there-

fore, seem strange that no classification of remedies has received universal support. In describing the properties and applications of drugs, the alphabetical arrangement is here adopted, as it is the most simple and it facilitates reference.

Different methods of classification of the articles of the Materia Medica have been employed for different purposes. Thus, a botanical basis may be adopted; or drugs and preparations may be arranged according to their chemical and pharmaceutical relations; or remedies may be classified according to their most prominent physiological or therapeutical effects. It is generally recognized that drugs affect function because they contain certain proximate principles, or extractives, by virtue of which they produce their physiological action and their therapeutical powers. A cinchona-tree which is grown in a botanical garden, and on this account contains no quinine in its bark, will have no medicinal value, and preparations of such bark will exert no therapeutic effect, except it may be through mental impressions upon the patient who thinks that he has taken an antiperiodic. In passing, it may be mentioned that one of the great sources of fallacy in clinical therapeutics exists in the varying quality of drugs and the consequent uncertainty as to their effects. This may be obviated to a large extent by using precautions to obtain only the best quality of drugs and to use what are called standardized preparations, in which the proportion of the active principle is ascertained and guaranteed to be uniform.

It is only proper to state that the therapeutical classification is necessarily only a general one, and many exceptions can be taken. Especially is it to be noted that it is not to be inferred that this classification is exclusive, and that, because the principal action of a remedy under ordinary circumstances is such as to warrant its being placed under a special heading, it might not also be entitled to a place under another heading. This difficulty arises from the multiple action of drugs, and that they often act upon several organs simultaneously. Thus a drug, like quinine, may be an antiseptic and it may also be a stimulant, or an antiperiodic. As an incidental effect it may act as a depressant or cause certain eruptions on the skin. The oil of turpentine is an antiseptic and a stimulant to the digestive organs and the heart, it is also a diuretic; but it is capable in some cases of causing toxic symptoms and general inflammation of the skin, or strangury and nephritis, even from small doses. With reference to this peculiar personal susceptibility of individuals to the action of drugs, called for convenience idiosyncrasy, no satisfactory explanation can be given. Thus, opium, instead of acting as a narcotic as it generally does, sometimes acts as a stimulant; morphine in some individuals causes wakefulness and vomiting and annoying itching of the skin. Cannabis Indica may cause delirium and nervous excitement instead of soothing the nervous system. In some cases alcohol acts like a narcotic poison, in others it produces acute mania. In the consideration of the actions of drugs in the next section many such examples will be referred to. Enough have been mentioned here to prove the statement that classification of drugs according to their effects upon the human body is only tentative and suggestive at the best, and is subject to many corrections as applied to individual cases. The therapeutist, being aware of the incidental effects of drugs, is constantly on the alert to modify his treatment when they are manifested.

Remedies may be divided into classes (after Garrod):—

Classification of Medicines.

- **External Remedies**
  - Irritants.
    - Rubefacients.
    - Epispastics or blistering agents.
    - Pustulants.
    - Escharotics and Caustics.
  - Sedatives.
  - Demulcents.
  - Emollients.
  - Astringents and Styptics.
  - Antiparasitics.
- **Internal Remedies**
  - Medicines Affecting Nutrition
    - Blood-tonics (hæmatinics).
    - Alkalies.
    - Acids.
    - Astringents.
    - Refrigerants.
    - Antipyretrics.
    - Alteratives.
    - Antitoxins and Serums.
    - Glandular extracts.
  - Medicines Acting through the Nervous System
    - The Brain
      - Exhilarants.
      - Hypnotics and Anodynes.
      - Anæsthetics.
    - Spinal Cord
      - Stimulants.
      - Sedatives.
    - Nerve-centres and Ganglionic System
      - Antiperiodics.
      - Tonics.
      - Antispasmodics.
    - Heart and Circulatory System
      - Vascular stimulants.
      - Vascular sedatives.
    - Special Organs
      - Alimentary Canal
        - Sialagogues.
        - Antisialics.
        - Emetics.
        - Anti-emetics.
        - Purgatives.
        - Anthelmintics.
        - Stomachics.
        - Intestinal Antiseptics.
      - The Liver
        - Hepatic stimulants.
        - Hepatic depressants.
      - Respiratory Apparatus
        - Expectorants (pulmonary stimulants.
        - Pulmonary sedatives.)
      - Cutaneous System
        - Anhydrotics.
        - Diaphoretics.
      - Urinary System
        - Diluents.
        - Diuretics.
        - Lithontriptics.
        - Antacids.
        - Antiseptics.
      - Generative System
        - Hæmostatics.
        - Ecbolics.
        - Emmenagogues.
        - Aphrodisiacs.
        - Anaphrodisiacs
      - The Eyes
        - Mydriatics
        - Myotics
- **Chemical Agents**
  - Antiseptics.
  - Disinfectants.

Irritants are applied to the skin in order to produce nervous and vascular reaction. According to the degree of their action, they are classed as **rubefacients,** or those which simply redden the surface; **epispastics** (or **vesicants**), those which occasion blisters; and **pustulants,** which excite sufficient inflammation to form pus. The rubefacients most in use are mustard, capsicum, arnica, turpentine, chloroform, ether, and iodine. Among vesicants are ammonia, cantharides, euphorbium, mezereum, and iodine. The principal pustulants are tartar emetic, croton-oil, and silver nitrate. The prolonged application of a rubefacient often gives rise to a blister.

Escharotics or **caustics** destroy tissues and lead to the formation of a slough. The principal escharotics are: liquefied phenol, glacial acetic acid, chromic acid, strong mineral acids, caustic potash, caustic soda, and the galvanocautery or actual cautery.

Local sedatives diminish nervous and vascular excitement in the part to which they are applied. They consequently relieve local inflammation and pain. Among agents of this group are bismuth, acetate of lead, aconite, cocaine, opium, belladonna, etc.

Demulcents are bland substances used to protect, mechanically, the gastro-intestinal tube from contact with irritant poisons, to allay inflammation of the same canal, of the respiratory or genito-urinary passages. Many of them possess some nutritive value. This class embraces acacia, flaxseed, elm, marshmallow, Iceland and Irish moss, starch, gelatin, olive-oil, etc.

Emollients are applied to the external surface. They resemble demulcents in being of a bland, soothing character, protect the surface from friction and from air, relieve tension, and diminish pain. Among emollient substances are: lard, olive-oil, spermaceti, glycerin, starch, cacao-butter, etc.

Local Astringents and Styptics.—The astringents and acids, which are useful in checking hæmorrhages and morbid discharges when administered internally, usually have the same effect when locally applied.

Antiparasitics.—The term **antiparasitic,** or **parasiticide,** is generally restricted to agents which have the power of destroying the animal and vegetable parasites which may infest the exterior of the body. The principal antiparasitic remedies are: sulphur, iodine, salts of mercury, liquefied phenol, and boric acid.

Hæmatinics are given internally to influence favorably the composition of the blood. Useless, or even deleterious in health, such a drug tends to improve, in certain diseased states, the quality of the blood, and, consequently, the nutrition of the entire organism. Destruction of its corpuscular elements and drain of its albumin indicate that the nutrient fluid-tissue urgently requires increased and appropriate pabulum. Remedies belonging to this class are, or contain, normal constituents of the body, and are necessary to the maintenance of structure and the performance of function. Prominent among the hæmatinics are preparations of iron, manganese, codliver-oil, other animal and vegetable oils, and a good diet.

Alkalies.—When alkalies, in concentrated form, are brought into contact with animal tisues, they enter into chemical combination with the oxygen present, and thus give rise to an active necrosis, or destructive inflammation. Alkalies are, likewise, solvents of albumin. These physical and chemical properties render the caustic alkalies useful in producing powerful counter-irritation. Their escharotic effects have been made use of in chronic synovitis, myelitis, and meningitis, and in the destruction of morbid tissue, whether of neoplastic or inflammatory origin.

The alkalies combine with and neutralize acids. Therefore, they are useful in overcoming hyperacidity of the stomach, whether due to the excessive production of hydrochloric acid or to fermentative changes, with the production of fatty acids. They promote the secretion of acid, and restrain that of alkaline, fluids. Hence, when administered immediately before a meal, an alkali excites a flow of gastric juice, and, in this way, promotes digestion and is serviceable in dyspepsia. On the other hand, given immediately after a meal, such a remedy, by neutralizing the gastric juice, corrects hyperacidity and relieves the symptoms of indigestion; it may, however, embarrass digestion and favor fermentation. It can readily be understood, therefore, how the prolonged use of alkalies in dyspepsia at length disorders appetite and aggravates the condition for which they were originally prescribed. A dilute alkaline solution checks the discharge of acute eczema, which possesses the same reaction; it allays the itching and smarting of this disease, or the burning pain of superficial burns and scalds. Paræsthesia, whether dependent upon constitutional disorder or excited by local causes, is often amenable to the influence of an alkaline lotion. The same preparation is beneficial by neutralizing acid secretions from the bowel, vagina, or the skin, and obviating their effects. Prolonged administration of an alkaline remedy may be injurious and give rise to emaciation and debility from the accelerated disintegration of nitrogenous tissue. These remedies aid in the resolution of inflammatory exudations.

A diminished alkalinity of the blood in rheumatism and gout is largely caused by the presence, respectively, of lactic or uric acid, with other excrementitious substances, in excessive quantity. The alkalies are advantageous in these diseases, combining with the acid and facilitating its elimination. The same result takes place in the urine. The reaction of that fluid being rendered alkaline, uric acid is dissolved or forms soluble combinations, irritation of the urinary tract is quieted, and the precipitation of the uric acid in the kidney or bladder is prevented. Alkalies are useful when a uric-acid calculus is present. They may be able to dissolve a small and soft stone. At all events, they prevent further deposit and relieve to some extent the irritation, which the foreign body and acid urine have occasioned.

Alkaline remedies consist of: potassium hydrate, potassium carbonate and bicarbonate, sodium hydrate, sodium carbonate and bicarbonate, lithium carbonate, calcined magnesia and magnesium carbonate, lime-water, precipitated calcium carbonate, and prepared chalk. The combinations of potassium, sodium, and lithium with the vegetable acids do not act as alkalies in the stomach, but, being converted into carbonates in the blood, they alkalinize the urine as they escape from the system. Finally, an alkali acts as a chemical antidote in poisoning by an acid.

Acids.—When given after meals, these supply the acid medium in which pepsin is efficient. They, therefore, improve the appetite and digestion, and are useful in digestive disorders. They promote secretion and allay thirst and nausea. Administered before a meal, by reducing the secretion of acid by the peptic glands, and by preventing fermentation, they check hyperacidity of the stomach. The mineral acids possess astringent properties, and are of service in lessening hæmorrhages, morbid secretions, and discharges. They are, likewise, usually antiseptic; they disinfect the alimentary canal and restrain deleterious fermentation of its contents. In a concentrated form they act as escharotics.

The properties of vegetable acids are similar to, but generally feebler than, those of the mineral acids. They are, however, with the exception of tannic acid, devoid of astringency. On the other hand, they exert a more decided influence upon the eliminative organs, and stimulate the secretions of the skin, kidneys, and bowels. In saturated solution the vegetable acids are irritant or even caustic. They have antiseptic virtues and assist digestion. Both mineral and vegetable acids are beneficial in certain morbid states of the blood, as purpura (or scurvy) and in fevers. The principal acids used are: acetic, benzoic, citric, lactic, tartaric, hydrochloric, nitro-hydrochloric, nitric, phosphoric, and sulphuric.

Astringents coagulate albumin and excite contraction of unstriped muscular tissue. In strong solution most of these substances exert a caustic action. They are useful in overcoming a relaxed or debilitated condition of muscular fibre, and, by contracting arterioles and capillaries and the gland-ducts, they repress secretion. They likewise restrain peristalsis. Astringents are of avail in the treatment of hæmorrhage and hypersecretion.

Agents of this class are derived both from the inorganic and organic kingdoms. The action of the vegetable astringents chiefly depends upon the presence of tannic acid or some of its modifications or allied forms. The principal members of this group of remedies are tannic and gallic acids, kino, catechu, krameria, geranium, and hamamelis. The mineral astringents comprise the salts of bismuth, zinc, alum, copper, lead, and silver. The salts of iron with mineral acids also exert a similar effect.

Refrigerant remedies are those which allay thirst produced by fever. The local action of water, as in the wet pack or Brand bath, or even pieces of ice allowed to melt upon the tongue, affords relief in cases of fever. Glycerin, topically applied, allays thirst by moistening the tongue. The vegetable and mineral acids, in weak solution, excite the secretion of saliva.

Antipyretics reduce abnormal temperature, either by limiting the generation of heat or by favoring its loss through radiation, conduction, and the work of evaporating the perspiration. Agents which diminish oxidation, depress the circulation, or which, presumably, exert a specific corroborant influence upon the heat-centre, lower temperature by lessening heat-production. Those which dilate the cutaneous vascular system favor the loss of heat. Immersion in water below the temperature of the body is a highly-valuable method of decreasing fever-heat.

Drugs which limit the production of heat by diminishing tissue-change are: acetphenetidin, antipyrin, acetanilide, benzoic acid, camphor, phenol, cinchonine, eucalyptol, quinine, resorcin, salycylic acid, salicin, and thymol. Those which lower the temperature by acting on the circulation are: aconite, antimony, digitalis, gelsemium, and veratrum. Drugs which increase radiation are: acetanilide, alcohol, spirit of nitrous ether, and thallin. Among those which dissipate heat in evaporating the perspiration are: antimony, nitrous ether, opium and ipecacuanha, and pilocarpus.

Alteratives.—This term has been bestowed upon a class of remedies which possess the power of modifying deranged nutritive processes. Given persistently, in small doses, alteratives improve the quality of the blood and often increase the number of its red corpuscles. Appetite, digestion, secretion, absorption, and elimination are promoted. The circulation and respiration are invigorated, and the nutrition and functional activity of the nervous centres improved.

Alteratives counteract the effects of various forms of toxæmia, as that of chronic malaria, syphilis, scrofula, tuberculosis, carcinoma, and of slow mineral poisoning.

The principal agents of this class are: gold and sodium chloride, preparations of arsenic, preparations of mercury, preparations of iodine, iodoform, iodol, potassium chlorate, antimony, mezereum, sulphur, sulphides, colchicum, guaiacum, sanguinaria, xanthoxylum, calcium chloride, stillingia, sarsaparilla, codliver-oil, and phosphorus.

Exhilarants determine an active cerebral circulation and stimulate the functions of cerebral centres; but if administered for too long a time or in excessive quantities, a depresing effect is produced. The effect upon the higher is reflected to the lower centres, the heart strengthened, the respiration deepened, and muscular vigor promoted. Substances belonging to this class support the system under prolonged and unusual strain, and are often useful in the treatment of mental alienation. Among exhilarants may be ranked the preparations of belladonna, hyoscyamus and stramonium, coca, tea, coffee, the primary action of ether, and alcohol.

Hypnotics and Anodynes.—Hypnotics cause sleep, anodynes allay pain. Sound sleep obliterates the perception of pain; the relief of pain, on the other hand, permits sleep. A close relationship exists, therefore, between these remedies. An hypnotic will often abolish pain, while an anodyne will frequently overcome wakefulness. In some substances, however, the hypnotic, and in others the anodyne, influence is more conspicuous. When sleeplessness depends upon anxiety, mental excitement, or prolonged intellectual effort, the treatment differs from that to be adopted when insomnia is due to pain. Hypnotics act chiefly by influencing the circulation through the brain, anodynes by their effect upon sensory centres.

The chief remedies belonging to this class are: opium, chloral-hydrate, chloralamid; potassium, sodium, and ammonium bromides, acetone, alcohol, paraldehyde, ethyl carbamate, sulphonethylmethane, and sulphonmethane.

Anæsthetics.—Agents of this class abolish consciousness and sensation by inhibiting the functions of the higher cerebral centres. When their influence is continued, the sensory and motor centres of the spinal cord and of the medulla oblongata are, in turn, affected. The first result of their inhalation is a stage of intellectual, emotional, and motorial excitement. This is succeeded by a stage of narcosis. Anæsthetics destroy life by paralysis of the centres situated in the medulla oblongata. They are employed for the purpose of relaxing spasm and producing a condition of unconsciousness, during which surgical operations may be painlessly performed.

The chief members of this group are: ether, chloroform, ethyl-bromide, ethyl chloride, and nitrous oxide.

Spinal Stimulants.—Agents belonging to this class, when given in medicinal doses, exalt the functions of the cord, invigorate the action of the heart and lungs, and promote secretion and nutrition, by influencing gastric motion and peristalsis.

These remedies are useful in atonic dyspepsia, atony of the bowel or bladder, cardiac weakness, emphysema, neuralgia, spinal neurasthenia, paralysis, and phthisis.

The principal members of this group are: nux vomica and its related species, ignatia, and alcohol and camphor in small doses.

Spinal Sedatives.—These are substances which have the property of

reducing the functions of the spinal cord. They may act directly upon the nerve-cells or produce their effect by an influence on the circulation through the cord. Excessive doses cause paralysis. Spinal sedatives are valuable in conditions of irritation, or congestive excitement, of the cord. The chief remedies belonging to the group are: potassium bromide, sodium bromide, lobelia, gelsemium, conium, hydrocyanic acid, potassium nitrate, physostigmine salicylate, and tobacco. Magnesium sulphate, when injected into the spinal cord, is a powerful sedative.

Antispasmodics.—Antispasmodic drugs allay irregular action of the voluntary or involuntary muscles by a calmative influence upon nerve-centres. They are of use in many disorders characterized by nervous excitement and muscular spasm, such as hysteria, colic, asthma, and intestinal colic. The principal antispasmodic remedies are: ammoniated valerian, asafetida, camphor, musk, castor, and ether.

Tonics.—Tonics improve appetite, digestion, assimilation, and secretion, strengthen the circulatory apparatus, improve the composition of the blood, invigorate the muscular system, and promote the nutrition of nerve-centres and fibres. The most powerful members of this class also possess antiperiodic virtues. Tonics are useful in the treatment of digestive disorders, in depressed conditions of the nervous system and nutrition in general, and in diseases characterized by periodicity. The former variety includes: gentian, calumba, chirata, serpentaria, and eucalyptus. The preparations of iron and manganese act as tonics when the quality of the blood is impaired. Certain mineral salts, as zinc oxide, silver oxide, and zinc sulphate, exert a similar influence in nervous affections, as chorea and epilepsy.

Vascular Stimulants.—Members of this class strengthen the action of the heart and blood-vessels. They are, therefore, advantageously employed in weakened conditions of the central organ of the circulation, in transudation due to blood-stasis, and in hæmorrhage. Chief among vascular stimulants are: alcohol, preparations of ammonium, caffeine, convallaria, digitalis, strophanthus, and scoparius.

Vascular Sedatives.—These remedies render the heart's action more slow and less forcible. They moderate cardiac excitement, and are of service in febrile and inflammatory affections of a sthenic type. Examples of this class are: aconite, veratrum, gelsemium, antimony, muscarine, pilocarpine, and hydrocyanic acid.

Sialagogues.—Sialagogues excite the secretion of saliva, either by an irritant local effect, with a reflex stimulation of the salivary glands, or by a specific influence upon the glands during their elimination. Examples of the former variety are: capsicum, mustard, ginger, pellitory, and mezereum: of the latter: preparations of iodine and mercury, pilocarpus, muscarine, and physostigma.

Antisialics check salivary secretion. This is the action of belladonna, opium, and potassium chlorate.

Emetics.—Emetics cause vomiting, either by irritating the terminal filaments of the gastric nerves or by exciting the nervous centre which presides over the act of emesis. Remedies which act by direct irritation are: alum, mustard, copper sulphate, zinc sulphate, and mercuric subsulphate. General or systemic emetics are: apomorphine, ipecacuanha, tobacco, and tartar emetic.

Anti-emetics allay irritability of the gastric nerves or the vomiting cen-

tre. Bismuth, cerium oxalate, creosote, carbolic acid, chloroform, ether, calomel, and silver nitrate soothe gastric irritation. Opium, hydrocyanic acid, bromides, and chloral-hydrate quiet the excitement of this nerve-centre.

Purgatives produce evacuation of the intestinal canal by increasing secretion, or transudation, along the tract and by exciting peristaltic movements. According to the intensity of their action, purgatives or cathartics are subdivided into several varieties: 1. Laxatives cause slight increase of secretion and peristalis, resulting in softened stools. Among laxatives are ranked manna, sulphur, figs, prunes, olive-oil, rhamnus purshiana, hyoscyamus, soap, etc. 2. Simple purgatives, or purgatives proper, are more decidedly stimulant, and occasion semiliquid motions. Belonging to this group are: senna, aloes, rhubarb, castor-oil, and calomel. 3. Drastic cathartics are strongly irritant to the intestinal mucous membrane, and occasion free transudation from its vessels and almost fluid stools. The action of drastics is often accompanied by considerable griping pain. Examples of drastics are: jalap, colocynth, gamboge, scammony, elaterium, podophyllum, and croton-oil. Excessive doses of simple purgatives have a very similar effect. 4. Hydragogue purgatives remove abundant serum from the intestinal blood-vessels and produce large, watery motions. Elaterium, cream of tartar, and croton-oil are illustrations. An analogous action is exerted by various salts of the alkalies and alkaline earths. Large doses of the drastic cathartics have the effect of hydragogues. The principal saline purgatives are sodium sulphate, magnesium sulphate, magnesium citrate, potassium tartrate and bitartrate, and potassium and sodium tartrate. 5. Cholagogue purgatives stimulate, either directly or indirectly, the liver, cause an increased flow of bile, quicken the peristaltic movements, and produce greenish, liquid evacuations. Among the cholagogues are included some salts of mercury, aloes, euonymin, iridin, rhubarb, leptandra, and podophyllum.

Anthelmintics cause destruction or expulsion of intestinal worms. Those agents which destroy are termed vermicides; those which expel are known as vermifuge remedies. Tape-worms are killed or removed by means of aspidium, kamala, kousso, pomegranate (or pelletierine), pumpkin-seed, turpentine, and chloroform. Remedies which act against round-worms are: santonin, spigelia, chenopodium, and azedarach. Seat-worms are destroyed by enemata containing table-salt, tannic acid, quassia, eucalyptol, etc.

Stomachics.—Stomachics stimulate the gastric mucous membrane, increase appetite, promote the secretion of gastric juice, and assist digestion. Carminatives restrain abnormal fermentation and dispel intestinal flatus. Among stomachics are: capsicum, piper, cardamom, cloves, mustard, and ginger.

Hepatic Stimulants.—These are medicines which excite the liver to increased functional activity. They occasion an augmented formation of bile, and thus promote the normal elaboration of nitrogenous aliment. The increased quantity of bile is not always accompanied by a corresponding increase in the characteristic bile-salts.

The principal substances which increase production of bile are: nitrohydrochloric acid, ipecacuanha, sodium phosphate, mercuric chloride, aloes, podophyllin, rhubarb, colocynth, euonymin, iridin, etc. The quantity of urea is increased by ammonium chloride, arsenic, antimony, phosphorus, and iron. The glycogenic function is stimulated by nitrohydrochloric acid, amyl nitrite, and sodium bicarbonate.

Hepatic Depressants.—Agents belonging to this class reduce func-

tional activity of the liver, diminishing the formation of bile, urea, and glycogen. Those which lessen the secretion of bile are: opium, lead acetate, alcohol, and quinine. The amount of urea is decreased by opium, alcohol, quinine, and colchicum. Glycogenesis is diminished by opium, phosphorus, arsenic, and antimony.

Expectorants.—Expectorant remedies modify the character of the bronchial secretions and facilitate their expulsion. Small or nauseating doses of emetic substances increase and liquefy the secretions of the mucous membranes. Larger doses, by causing vomiting, mechanically aid the expulsion of mucus from the air-passages. The term "stimulating expectorants" is given to a group of drugs eliminated by the bronchial mucous membrane, which they stimulate, and the secretion of which they at the same time alter and improve. Certain substances, when dissolved in the mouth, aid expectoration by a stimulating influence upon the cilia of the trachea and bronchi. These are called ciliary excitants. The nauseating expectorants are: antimony, ipecacuanha, apomorphine, lobelia, pilocarpus, etc. Among the stimulating expectorants are: ammonium chloride, balsams of Peru and Tolu, senega, squill, sulphur, and terpin hydrate. Ciliary excitants are: ammonium chloride, potassium and sodium chlorate, gum acacia, etc.

Pulmonary sedatives relieve cough by allaying irritability of the respiratory centre, or the terminal fibres of the nerves distributed to the bronchi and lungs. Examples of this class are: opium, belladonna, stramonium, hyoscyamus, hydrocyanic acid, etc.

Anhydrotics check excessive sweating; among them are atropine or belladonna, camphoric acid, mineral acids, especially aromatic sulphuric acid, also agaricin and adrenalin.

Diaphoretics increase perspiration by stimulating the sudoriparous glands in the course of their removal, as sulphur, guaiacum, sarsaparilla, serpentaria, mezereum, and camphor. Other agents produce the same effect by causing relaxation of the cutaneous capillaries. In this subdivision are found the nauseants and emetics, as tartar emetic, ipecacuanha, lobelia, and Dover's powder, as well as opium, ether, and alcohol. A third group of remedies excites diaphoresis by an influence upon the sweat-centres, as pilocarpus, veratrum, and salts of potassium.

Diuretics.—The quantity of urine excreted is increased by remedies which raise general or local arterial tension, and by those which stimulate the secreting cells of the kidney. The free ingestion of water assists the action of diuretic drugs, and is mechanically serviceable by irrigating the renal tubules. Among the stimulant diuretics are found cantharides, copaiba, cubeb, turpentine, colchicum, squill, broom, juniper, potassium acetate, and calomel. The principal agents which act by elevating blood-pressure are: digitalis, belladonna, nux vomica, and alcohol.

Lithontriptics.—This name has been given to a class of remedies which increase the flow of urine, and at the same time, by modifying its chemical reaction, dissolve and prevent the deposition in the urinary passages of uric, phosphoric, or oxalic acid, or insoluble salts of those acids. If precipitation has taken place, they are given with a view to dissolve or remove gravel or calculi. Potassium carbonate, bicarbonate, and citrate, and lithium carbonate and citrate are the principal solvents for uric acid. The agents which are given for the purpose of acting upon phosphoric calculi are: benzoic acid, ammonium benzoate, and diluted nitric acid.

Hæmostatics.—Agents for checking pulmonary hæmorrhage, or reducing excessive menstrual flow, or hæmorrhage from the uterus at other times than the monthly periods are frequently demanded. They may act either through the nervous system, as when atropine is injected hypodermically or oil of erigeron administered, or they may act through contraction of the muscular fibres, as when ergot or stypticin is given. Cold causes vaso-motor constriction, as when ice is applied to hæmorrhoids, or introduced into the vagina or rectum.

Ecbolics.—These remedies, also known as oxytocics, stimulate the pregnant womb to contraction. They may thus lead to abortion, if prematurely given, but, administered during labor, are often of valuable assistance by invigorating the organ. It is surmised that ecbolics may act either by causing direct irritation of the muscular structure of the womb, or exciting contraction through an influence upon the uterine centre in the cord. The principal ecbolics are: ergot, cotton-root bark, ustilago, quinine, and savin.

Emmenagogues.—Emmenagogues excite the menstrual flux either by a direct stimulant effect upon the uterus or indirectly by improving the quality of the blood and nutrition in general. Small doses of **ecbolic** remedies are usually emmenagogue. Direct emmenagogues are: ergot, savin, cantharis, rue, myrrh, etc. Indirect emmenagogues are: preparations of iron and manganese, nux vomica, codliver-oil, etc.

Aphrodisiacs excite the sexual appetite and the genital functions. This object they accomplish by stimulation, either direct or reflex, of the centres which govern the genital organs. Whatever promotes nutrition tends indirectly to invigorate the sexual apparatus. The chief aphrodisiac agents are: cantharis, phosphorus, alcohol, camphor, and cannabis Indica.

Anaphrodisiacs diminish sexual desire and power. They allay excitability of the genital centres and diminish irritation or hyperæmia of the generative organs. Among anaphrodisiacs are included potassium, sodium, or ammonium bromide; potassium iodide; large doses of camphor or opium; tobacco, gelsemium, etc. Whatever depresses general systemic vigor has likewise an indirect anaphrodisiac effect.

Mydriatics produce dilatation of the pupil by stimulation of the end-organs of the sympathetic, with contraction of the radiating fibres of the iris as a result, and by paralysis of the third nerve, causing relaxation of the circular fibres. The principal mydriatics are: atropine, cocaine, homatropine, daturine, duboisine, and hyoscyamine.

Myotics cause the pupil to contract by stimulating the circular fibres of the iris. Eserine, or physostigmine, thus acts when locally applied, and is used by ophthalmologists for this purpose. Other drugs which contract the pupil, though not administered for that purpose, are opium, pilocarpus, and muscarine.

Antiseptics act upon pathogenetic micro-organisms, prevent their growth and multiplication, and thus protect the system against infection. The most valuable antiseptics are: mercuric chloride and iodide, carbolic acid, creosote, salicylic acid, chlorine, naphthol, quinine, thymol, sulphurous acid, iodine, iodoform, resorcin, etc.

Disinfectants are used for the purpose of destroying the organic germs of disease, as they may exist in the atmosphere, clothing, water, pathological discharges, etc. Substances which accomplish this purpose are: Formaldehyde, sulphurous-acid gas, chlorine, bromine, zinc chloride, mercuric chloride, etc. A high degree of heat is also disinfectant.

Dosage.—By the dosage of a remedy is meant the definite quantity of the agent required to produce a desired therapeutical result. Naturally a considerable margin exists, owing to different degrees of vigor in patients, and to the amount of impression we desire to make upon the bodily functions. It is evident, then, that, even among patients of the same age, some will require larger doses than others in order to produce a particular effect. Thus arises the distinction between the **minimum** and **maximum** doses, the former being the smallest dose capable of physiological or therapeutical effect, the latter being the largest dose which it is considered safe to give. The toxic dose rapidly develops the physiological action of the drug in a high degree, giving rise to the characteristic symptoms of poisonous action of the remedy. **Broken** or **fractional** doses are merely doses much smaller than those usually given, and intended to develop the physiological effects by degrees, being the reverse of toxic doses in the sense that they singly produce no marked disturbance, and are within perfectly safe limits. In the following pages reference may be found to a **full** or **single dose**, the **interrupted dose**, and the **continued dose**. The **full dose** is the maximum amount which the patient will require to produce the physiological action of the remedy, and it is usually not intended to be repeated. For instance, an ounce of magnesium sulphate, or several cathartic pills, may be ordered to accomplish a certain therapeutical result, and, this being obtained, there is no need to give any more. Where the symptoms tend to recur, as where purgative remedies are required in chronic constipation, or amyl nitrite for angina pectoris, it becomes necessary to repeat the administration of the remedy from time to time, the system having opportunity to recover fully from the effects of one dose before another is administered. The **interrupted dose** is generally smaller than the full dose, although exceptionally it occurs that by the frequent repetition of a remedy the system becomes accustomed to it, and larger doses are required to produce the same effect. The **continued dose** is where each succeeding dose is given before the effects of the preceding have passed away, so that when the intervals are short a **cumulative action** of the remedy is seen. The latter obviously depends upon the rate of elimination of the agent; some drugs, like alcohol or ether, are excreted very quickly, and exert a cumulative action only when the intervals are very short; others, like arsenic, mercury, and digitalis, are excreted slowly, and may show a cumulative effect after awhile, even when only one or two doses are given daily. The alternating administration of drugs by **rotation**, as a practical principle of treatment, is designed to overcome the tendency to toleration of drugs by the system. Rotation has been advocated by Ewart[1] on these grounds: 1. Some drugs—and these are chiefly the stimulants and the sedatives—lose more and more of their effect the longer they are continued. 2. Other drugs, being slowly eliminated or distinctly cumulative, acquire through prolonged administration an increased activity, and in some instances a modified, and sometimes a dangerous, action. 3. The most active dose, in the case of any stimulant or sedative, and in that of many tonics, is (putting aside summation of doses or of their effects) the first dose. These considerations led Ewart to the adoption of a principle which may be regarded as novel, that of a systematic "rotation of drugs," which, not unlike the farmer's "rotation of crops," rests as well as fertilizes.

[1] *British Medical Journal*, Oct. 1, 1898, p. 938.

Without advocating an excessive polypharmacy, it appears evident that patients may often be placed with advantage under the joint influence of several drugs; but in some cases they will derive most benefit from a frequent renewal (thanks to intervening breaks) of the first impression which had been produced by each drug. An alternating rotation—daily, tertian, or of any other period—of the drugs to be administered would work in the same direction.

Systemic, Specific, and Analeptic Remedies.—A **systemic** remedy is one which is not designed to especially affect the organs by which it enters the circulation, nor those by which it is finally excreted; it is given with a view of bringing about some change in the general solids or fluids of the body, so as to affect nutrition, and, as a rule, does this through some effect upon the nervous system. Remedies designed to affect special organs, such as the liver, kidneys, heart, genito-urinary tract, or alimentary canal, are local or organic remedies. Remedies are also divided into inorganic and organic, in relation to their nature and origin, as they belong to the mineral kingdom or to the animal or vegetable kingdom. A **specific** remedy is one having the power to stop the course of a particular disease and act as an antidote to its effects. There are no "sure cures" in medicine, and no true specifics. Still, the manifestations of malaria are so uniformly controlled by cinchona, syphilis by mercury, rheumatism by salicylic acid, and gout by colchicum, that these remedies are considered as approaching the character of specifics, although they sometimes fail, and often must be combined with other remedies in order to produce the best results. **Analeptic** remedies are those which build up the system; they are tonics and restoratives; they stimulate the nutritive functions, and some of them, such as codliver-oil, act as food.

A remedy is sometimes said, technically, to be "indicated" when the symptoms show that the function of some part of the body is disordered; and our knowledge of the physiological action and clinical effects of the remedy indicates to us the probability that its administration would produce a favorable result; thus, an emetic would be indicated in narcotic poisoning or in croup, a purgative would be indicated in fæcal impaction of the bowels or in cerebral congestion; the sponge-bath and antipyretics are indicated in fever. It is not meant that there is any mysterious relation existing between certain diseases and particular remedies in the sense that nature is crying out for a certain drug, and that no other would be serviceable, or that the patient would necessarily die if the medical attendant failed to discern the indication or to decipher the cabalistic inscription by which nature tests his skill.

Diseases arise from causes; the object of treatment is (1) to remove the cause of disorder, if possible, and if not (2) to obviate its effects by removal of the patient to more sanatory surroundings, or placing him in an improved physical condition, and better able to resist the further progress of the disease; (3) to make the patient comfortable; (4) to avert any fatal tendency which may arise; and (5) to do everything possible to hasten his recovery. This is rational medicine; it is also scientific medicine because based upon exact knowledge of the effects of drugs and other remedial agents. From various sources an immense fund of information has been collected and classified. The application of this knowledge to individual cases of disease constitutes the art of medicine, or practical therapeutics.

PART II.

PHARMACEUTICAL THERAPEUTIC AGENTS, OR DRUGS.

In this section will be considered, systematically and in alphabetical order, the remedial agents or drugs in present use in the treatment of disease. All of the drugs and preparations made official by the United States and British Pharmacopœias receive notice and consideration in proportion to their importance. Some of the most valuable of the new remedies which are coming largely into use by the profession have also been introduced, these being distinguished from the official agents by the absence after them of the letters U. S. P. or B. P.

Each drug will be considered individually and from three different points of view: (1) the botanical or chemical definition and physical characters of the remedy, with the strength and dosage of its various preparations; (2) its physiological actions, including toxicology and antidotes, with special effects, if any, upon individual organs and tissues; and (3) the therapeutical indications, with illustrative formulæ, comments, and suggestions as to eligible forms of administration, or cautions concerning its use. This arrangement is the one which has been found by experience to be the most convenient to facilitate reference and study.

ABRUS.—Jequirity, Wild Licorice, or Abrus precatorius (Leguminosæ).

Pharmacology and Toxicology.—Abrus is a native of India, but grows elsewhere in the tropics. The part used in medicine is the seed, or bean. These are small, nearly round, of a bright-red color, with a black spot at the hilum. The poisonous constituents are a globulin, and an albumose, the action of which closely resembles that of toxins of bacterial origin. These bodies, of similar chemical composition, are both extremely toxic, and their systemic effects have been likened to those produced by the venom of the snake. The temperature is lowered and the blood remains fluid after death (Martin and Wolfenden). The seeds do not contain an alkaloid. The root contains glycyrrhizin (15 per cent.) and an acrid resin (8 per cent.). The leaves contain 10 per cent. of glycyrrhizin.

Therapy.—The infusion is made by triturating three seeds in a mortar with an ounce of cold water, to which is added an ounce of hot water. When cold, the solution is filtered; the resulting filtrate, containing the globulin and albumose, if introduced into the eye, is highly irritating, and sets up a purulent inflammation. It has accordingly been successfully used in ophthalmological practice in the treatment of granular lids, or trachoma. It is applied three times the first day and repeated on the second and third days, if necessary. This powerful application should be made with care, since Dr. T. E. Murrell describes three cases of stricture of the nasal duct that had resulted from its careless use or too frequent application. Hypodermic injections produce local gangrene.

The cases in which jequirity is apt to prove most serviceable are the later stages of trachoma or the fibrous state of the conjunctiva following trachoma. Good results also follow its cautious use in vascular keratitis produced by a burn. The powdered drug may be applied by means of a

camel's-hair brush to the everted lid, a very small quantity being used, at first, in order to avoid an excessive reaction. Jequirity has been employed in chronic suppurative otitis, and also in chronic metritis. Solutions should be recently made, as they rapidly undergo decomposition.

Abrus is not used internally. Injection of the infusion into the circulation of the lower animals causes death by cardiac depression.

ABSINTHIUM.—European Wormwood: consists of the leaves and tops of Artemisia Absinthium (Compositæ).

Preparations.—Wormwood has no official preparations.

Pharmacology.—An herb, bitter and aromatic to the taste, indigenous to Europe, but naturalized in this country, and common along waysides. It contains the glucoside **Absinthin** and a very bitter resin; the former of which is soluble in water, alcohol, and ether. Wormwood also contains an acrid, volatile **oil,** more in the dried plant than in the fresh state. The oil consists largely of **Thujone,** or **absinthol,** with a blue coloring principle. A liqueur, flavored with aromatics, called **Absinthe,** is used to a large extent as an intoxicant in France, where its pernicious effects have attracted the attention of sanitarians. The constant use of absinthe produces profound disorders of the nervous system, epileptiform convulsions, and renders the subject a physical wreck. These effects are similar to those produced by the volatile oil of wormwood upon the lower animals, in which it acts as a depressor of nervous energy, followed by stupor, clonic muscular spasms, and fatal coma. According to the experiments of Cadéac and Albin Meunier upon animals, the oil of wormwood, in small and large doses, possesses decided antiseptic properties. The oil is frequently adulterated with oil of turpentine.

Toxicology.—Poisonous effects may be counteracted by cold affusions, followed by friction of the skin and sinapisms, with careful administration of ammonia by inhalation, or by the mouth, or by injection under the skin, or into a vein. Evacuation of the contents of the stomach should be obtained by stimulating emetics, or, if these fail, by the stomach-pump. The treatment of **absinthism** calls for hygienic and restorative measures, particularly nerve-tonics, in addition to the usual treatment of alcoholism. The use of absinthe as a stimulant should be discouraged on account of the grave deterioration, moral and physical, which it produces.

Therapy.—Wormwood has been used medicinally in the form of infusion (4 to 8 Gm. to 473 c.cm., or ʒi-ij to Oj), a wineglassful being the dose, as a tonic or as an anthelmintic, for children. The infusion is likewise employed as an enema for the destruction of thread-worms.

Hiccough due to flatulent distension may be checked by the administration of a few drops of the volatile oil. The dose of the powdered leaves is 1.30 to 2.60 Gm. (or gr. xx-xl), or, of the oil, 0.06 to 0.18 c.cm. (or *m*i-iij).

It is a domestic remedy for flatulent dyspepsia and weak digestion. Externally, it has been used as a stimulant application to indolent ulcers. According to Dr. J. L. Corning, the volatile oil of wormwood is a valuable local anæsthetic, and may be serviceably applied for the purpose of relieving rheumatic pains. A wine slightly tinctured with wormwood, known as **Vermouth,** is sometimes given to increase appetite and hasten convalescence. Absinthin has been employed recently as a bitter tonic in doses of 0.015 Gm. (or gr. $^1/_4$ before meals. The German Pharmacopœia recognizes an extract and a tincture of absinthium.

ACACIA (U. S. P.).—**Acacia (Gum Arabic, Gum Senegal).** The dried, gummy exudation from Acacia Senegal, Willdenow, or from other species of Abrus (Leguminosæ).

ACACIÆ GUMMI (B. P.).—**Gum Acacia.** A gummy exudation from the stem and branches of Acacia Senegal and of other species of Acacia.

Preparations.

Syrupus Acaciæ (U. S. P.).—Syrup of Acacia (acacia, 100 parts, with sugar, 800, and distilled water to make 1000 parts). Dose, 2 to 7.5 c.cm. (or f℥ss-ij).

Pulvis Cretæ Compositus (U. S. P.).—Compound Chalk Powder (prepared chalk, 30; acacia, 20; sugar, 50). For making chalk mixture. Dose, 1.67 to 4 Gm. (or gr. xx-3j).

Mucilago Acaciæ (U. S. P., B. P.).—Mucilage of Acacia (U. S. P. contains 34 parts, with lime-water 33, and plain water enough to make 100 parts by weight). Dose, 2 to 7.5 c.cm. (or f3ss-ij).

These are the only official preparations of acacia, and are simply used as vehicles. The density of the solution of gum arabic enables it to be used to suspend insoluble powders or oils; in the latter case the resulting mixture forms an *emulsion*.

Pharmacology.—Gum arabic comes in white, or nearly colorless, translucent, irregular lumps, which are brittle, odorless, and almost tasteless. Its solution is valued for its adhesive qualities. Acacia also possesses some nutritive properties, and in the East it is eaten as food. It is soluble in water, but insoluble in alcohol. It has a faint odor and a mucilaginous, insipid taste. Acacia consists of a peculiar principle called **arabin,** or **arabic acid,** united with calcium, potassium, and magnesium. Arabin is described as an amorphous, glassy, and transparent substance when dry and of a milk-white color when moist. The solutions of acacia readily undergo acetous fermentation, unless some antiseptic is added to preserve them. As a rule, they should be freshly made.

Therapy.—In bowel disorders and fevers, a thin mucilage, flavored with lemon and sweetened, makes a nourishing, bland drink which relieves thirst. Irritation in the throat is relieved by gum-arabic troches. Coryza is relieved by a snuff of acacia and bismuth subnitrate, to which a little morphine may be added, as in Ferrier's snuff:—

℞ Morphinæ sulphatis		32 Gm. or gr. v.
Pulveris acaciæ	8	Gm. or 3ij.
Bismuthi subnitratis	23	32 Gm. or 3vj.

M. et ft. pulvis.
Sig.: A few grains to be snuffed into the nostrils, as directed.

For sore nipples, a good combination is as follows:—

℞ Pulveris acaciæ	15	5 Gm. or 3iv.
Pulveris sodii boratis	4	Gm. or 3j.
Pulveris camphoræ		32 Gm. or gr. v.
Pulveris marantæ	8	Gm. or 3ij.

M. Sig.: Dust over the surface.

Another serviceable application, in some diseases of the skin, is:—

℞ Pulveris acaciæ	12	Gm. or 3iij.
Pulveris zinci oleatis	2	Gm. or 3ss.
Adipis lanæ hydrosi	15	5 Gm. or ℥ss.

M. Sig.: Ointment for sore nipples, intertrigo, or acute dermatitis.

Powdered gum arabic may be used to check bleeding from leech-bites. The mucilage acts as a protective to slight burns and excoriations.

The emulsion may likewise be employed as a demulcent vehicle in bronchitis, and in irritation of the genito-urinary passages.

Gum arabic is chiefly employed for pharmaceutical purposes, in the preparation of emulsions, pills, etc.

ACETANILIDUM (U. S. P., B. P.).—**Acetanilide**, or **Phenyl-acetamide. Acetanilide** (B. P.). Also known by trade name of **Antifebrin.**

Dose, 0.06 to 0.30 Gm. (or gr. j-v). B. P., 0.065 to 0.2 Gm. (or gr. i-iij).

Preparation.

Pulvis Acetanilidi Compositus (U. S. P.).—Compound Acetanilide Powder. (Acetanilide, 70; caffeine, 10; and sodium bicarbonate, 20 parts.) Dose, 0.10 to 0.60 Gm. (or gr. ij-x).

Pharmacology.—Acetanilide is an acetal derivative of aniline. It is a white powder, of neutral reaction, slightly pungent, without odor, slightly soluble in water and freely soluble in ether and in alcoholic solutions. It is not changed by acids or alkalies.

Physiological Action.—In ordinary dose, the action of acetanilide is much less marked upon a person in health than when fever is present, as its most evident action is to reduce temperature, possibly by converting oxyhæmoglobin into methæmoglobin in the red blood-corpuscle and interfering with oxidation. The effect does not depend upon sweating, since it occurs when no perspiration is produced. Acetanilide, which at first was introduced as an antipyretic, has been found to possess remarkable analgesic power. It is the chief constituent of popular headache remedies, to take the place of which the compound acetanilide powder was introduced into the pharmacopœia. When a toxic quantity has been absorbed the patient becomes prostrated, the lips and finger-nails are dark colored, the pulse rapid and compressible, and the skin pale and moist; the alkalinity of the blood is lessened, many red corpuscles destroyed, hæmoglobin is liberated and eventually appears in the urine, which becomes dark brown in color. The quantity of uric acid and urea in the urine is increased. Peptonuria may be produced. The drug is eliminated by the kidneys. Large doses cause diastolic arrest of the heart, preceded by tremors, convulsions, depressed temperature, coma, and motor and sensory paralysis. By smaller doses, the action of the skin and kidneys is increased; the blood-pressure is at first elevated, but soon falls, and the heart's action decreases. In some cases, however, whether owing to peculiar susceptibility, or impurity in the drug, symptoms of poisoning—cyanosis and collapse—have resulted even from small doses. Vomiting or profuse sweating have also followed moderate doses of acetanilide. Toxic symptoms are especially apt to occur when acetotoluid is present as a contamination. The ill effects of the drug must be counteracted by use of external heat, vigorous alcoholic stimulation, together with the hypodermic use of ether, atropine, and strychnine, in order to support the respiration and circulation. In patients suffering with fatty or dilated heart, acetanilide should be used with great caution, if at all. Owing to its action upon the blood-cells, it should not be used repeatedly or in full doses, in the low fevers. The prolonged administration of acetanilide gives

rise to congestion of the liver, spleen, and kidneys. In animals poisoned by acetanilide the heart, liver, kidneys, and other organs have been found affected by fatty degeneration. When used as a dusting-powder, combined with an equal quantity of starch or zinc stearate, in the treatment of intertrigo of infants, it has caused death from absorption of the drug, in several cases (*Journal of the American Medical Association*, Feb. 1, 1896, p. 239).

Therapy.—Acetanilide possesses antiseptic properties and may be advantageously used as a local remedy. It is an efficacious local application to chancroids and ulcerated chancres, used as a dusting-powder. In the form of an ointment containing 1.30 Gm. (or gr. xx) to 31 Gm. (or ℥j) it is of service in obstinate and irritable ulcers, erysipelas, eczema, herpes, urticaria, and other diseases associated with considerable irritation. Combined with a mercurial it exercises a beneficial influence upon the lesions of psoriasis. A gargle, containing 0.25 Gm. (or gr. iv) of acetanilide to 30 c.cm. (or f℥j) of water, may be beneficially employed in pharyngitis. Finely-powdered acetanilide and boric acid constitute an excellent dressing to burns, scalds, and small lacerated wounds. In many cases it has been found to prevent the production of pus. It has a beneficial influence upon ulcers and has been applied with success to mucous patches.

Given in fever (0.20 Gm., or gr. iij, or less) every hour, it usually is followed by prompt reduction of the temperature to the normal. It is also antispasmodic, and has been used in small doses in epilepsy, asthma, and whooping-cough. In whooping-cough it is given in the dose of 0.03 to 0.32 Gm. (or gr. ss-v), according to the age and condition of the child. Improvement has taken place in chorea, also, in consequence of its administration. For the relief of pain it has been employed in nervous affections, and relieves attacks of facial neuralgia, locomotor ataxia, sciatica, etc., in doses of 0.06 to 0.30 Gm. (or gr. i-v). In migraine, or neuralgic headache, it is also an efficient remedy. Acetanilide is highly esteemed in the treatment of dysmenorrhœa, especially of young girls. In doses of 0.20 to 0.32 Gm. (or gr. iii-v) thrice daily it is of value in relieving seasickness. Acetanilide may be used with lupulin for the affections just named:—

℞ Acetanilid.,
Lupulini ..... aa 6|50 Gm. or gr. c.

M. et ft. capsulæ no. xx.
Sig.: One or two capsules every two or three hours.

It may be employed with camphor, as—

℞ Camphoræ ..... 3|25 Gm. or gr. l.
Acetanilid. ..... 6|50 Gm. or gr. c.
Olei theobromatis, q. s.

M. et ft. suppositoria no. x.
Sig.: Insert one into the bowel every two or three hours, for the relief of neuralgia.

In traumatic tetanus, doses of 0.25 to 0.38 Gm. (or gr. iv-vj) of acetanilide every third or fourth hour, in conjunction with hypodermic injections of carbolic acid, have been used with success.

A combination of value in the treatment of neuralgia, headaches, muscular and acute articular rheumatism, dysmenorrhœa, influenza, and various febrile affections is thus given by Dr. W. Blair Stewart:—

℞ Acetanilid.,
Quininæ bisulphat..... aa | 065 Gm. or gr. j.
Cocainæ hydrochloridi..... | 004 Gm. or gr. $^{1}/_{16}$.—M.

The ingredients are compressed into the form of a tablet triturate, and one tablet can be administered every three or four hours, according to its effect and the nature of the case.

Acetanilide is said to be of value in the treatment of obstinate vomiting, especially when due to nervous disturbance or extreme irritability of the stomach. It has also been employed with success in order to relieve the vomiting which follows surgical operations or the use of an anæsthetic.

Dr. Hollopeter recommends, in simple fevers of children, the following combination:—

℞ Acetanilid. ..... 1 | 20 Gm. or gr. xviij.
Hydrarg. chlor. mitis..... | 065 Gm. or gr. j.
Sodii bicarb. ..... | 75 Gm. or gr. xij.
Sacch. lact. ..... 1 | Gm. or gr. xv.

M. et ft. chart. no. xij.
Sig.: One every two hours until three are taken.

ACETONUM (U. S. P.).—**Pyroacetic Spirit,** or **Ether** (C_3H_6O or CH_3COCH_3).

Dose, 1 to 1.3 c.cm. (or *m*xv-xx), dissolved in spirit of nitrous ether.

Acetone is a liquid containing not less than 99 per cent. by weight of absolute acetone (dimethylketone). It should be kept in well-closed vessels in a cool place, remote from lights or fire.

Therapy.—Pyroacetic spirit has a peculiar ethereal, faintly mint-like, odor, and a pungent, sweetish taste. It has been used as an antipyretic, or febrifuge, and as a sedative for cough, especially in pulmonary tuberculosis. It has also been used to relieve flatulence and pain in colic, attending diarrhœa or dysentery. It checks vomiting. When inhaled, it has some anæsthetic effect, but causes bronchial irritation. It is a mild hypnotic and analgesic, and has been used in rheumatism and gout. Acetone is a constituent of the urine in diabetes, and occasionally in that of healthy individuals while on a proteid diet.

ACETPHENETIDIN (U. S. P.).—(See **Phenacetine.**)

ACIDUM ACETICUM (U. S. P., B. P.).—**Acetic Acid,** composed of 36 per cent., by weight, of absolute acetic acid, U. S. P.; 33 parts of hydrogen acetate, B. P.

ACIDUM ACETICUM GLACIALE (U. S. P., B. P.).—**Glacial Acetic Acid,** nearly or quite absolute acetic acid (contains 99 per cent. of $C_4H_2O_2$).

Preparations.

Acidum Aceticum Dilutum (U. S. P., B. P.).—Diluted Acetic Acid contains 6 per cent., by weight, of absolute acetic acid, U. S. P.; 4.27 parts of hydrogen acetate, B.P. The German dilute acetic acid is 30 per cent.

Linimentum Terebinthinæ Aceticum (B. P.).—Liniment of Turpentine and Acetic Acid (composed of oil of turpentine, glacial acetic acid, and liniment of camphor).

Dilute acetic acid is the basis of the Aceta, or official vinegars, except Acetum Cantharidis (B. P.), which contains glacial acetic acid.

Pharmacology and Toxicology.—Acetic acid is a clear, colorless fluid, having a strong vinegar-like odor, with acid taste and reaction. It mixes with water or alcohol in all proportions. Glacial, or absolute, acetic acid is a

crystalline solid at 59° F.; it attracts moisture from the atmosphere, and should therefore be kept in well-stoppered bottles. Acetic acid in the strongest form acts as an escharotic to the tissues; and, if taken internally, is a violent corrosive poison, causing vomiting of sour-smelling liquid, also intense pain, followed by convulsions and fatal coma. If the case is prolonged, gastro-enteritis is produced by the acid. It has some antiseptic qualities, and, if swallowed, slightly increases the acidity of the urine.

Acetum, or vinegar, which contains from 6.3 to 7 per cent. of acetic acid, is not official in either the United States Pharmacopœia, or British Pharmacopœia. as dilute acetic acid takes its place. The use of a 60-per-cent. acetic acid is recommended by good authority as a menstruum for extracting the active principles of drugs, with which it seems, in many instances, to form soluble compounds.

Pyroligneous acid, or crude acetic acid, a dark-brown fluid having a smoky odor, obtained from the destructive distillation of wood, may be used with advantage as a disinfectant. Glacial acetic acid is partially eliminated by the intestinal canal, but chiefly by the kidneys. In cases of poisoning, milk or flour and water should be freely given, and vomiting encouraged. Weak alkaline solutions should be administered as chemical antidotes.

Therapy.—Glacial acid is used successfully as an application to lupus, epithelioma, ulcers, papillomata (or warts), and nasal hypertrophies, and also as an application to ringworm and other forms of tinea. A mixture of 30 parts of acetic acid and 2 parts of salicylic acid is esteemed an efficacious application to venereal warts. Vinegar (not official), or dilute acetic acid, has been given internally to check night-sweats and to relieve diarrhœa. After constipation has been overcome vinegar has been employed with good effect in the treatment of lead colic. Vinegar is a convenient antidote for poisoning by caustic alkalies. It is also used externally for the relief of headache, and the entire surface of the body may be sponged several times a day with vinegar and water to reduce high temperature and acid sweating. It will also prevent the formation of bed-sores. The vapor of vinegar diffused through the sick-room is, according to Dr. S. J. Bumstead, of Decatur, Ill., beneficial in cases of catarrhal, membranous, and diphtheritic croup. Engelmann claims that the direct application of vinegar answers a good purpose in diphtheria. Warholm recommends the use of vinegar for the purpose of relieving or preventing nausea, vomiting, and headache following the inhalation of chloroform. A compress saturated with the liquid is placed over the nose and kept in that position until consciousness has returned.

The following liniment is useful in chronic rheumatism of the joints. It is Stokes's or St. John Long's liniment, the Linimentum Terebinthinæ Aceticum of the National Formulary:—

℞ Ol. terebinth.	100	c.cm. or f℥iiiss.
Ovum recent.,		
Ol. limonis	4	c.cm. or f℥j.
Acid. acetic.	20	c.cm. or f℥v.
Aquæ rosæ	85	c.cm. or f℥iiss.

M. et ft. linimentum.

Properly diluted, acetic acid is sometimes able to mitigate the intense pruritus of urticaria. It is capable also of checking moderate bleeding, as from leech-bites, superficial wounds, and epistaxis. In post-partum hæmorrhage, weakened acetic acid, or vinegar and water, expressed from a mop or sponge into the cavity of the womb, will cause that organ to contract and

prevent the loss of more blood. Acetic acid may be of service in bleeding from the stomach. Dr. E. Maguire reports good results in acute gonorrhœa from the use of injections, consisting of 1 part acetic acid to 4 of water.[1]

ACIDUM ARSENIOSUM (B. P.).—**Arsenious Anhydride.**

Dose, 0.001 to 0.004 Gm. (or gr. $^1/_{60}$-$^1/_{15}$).

ARSENI TRIOXIDUM (U. S. P.).—**White Arsenic** (As_2O_3).
ACIDUM ARSENOSUM (U. S. P., 1890).

Dose, 0.002 to 0.005 Gm. (or gr. $^1/_{30}$-$^1/_{12}$).

U. S. P. Preparations.

Arseni Iodidum.—Arsenic Iodide. Dose, 0.0027 to 0.008 Gm. (or gr. $^1/_{24}$-$^1/_8$).

Sodii Arsenas.—Sodium Arsenate. Dose, 0.0027 to 0.005 Gm. (or gr. $^1/_{24}$-$^1/_{12}$).

Sodii Arsenas Exsiccatus.—Dried Arsenate of Sodium. Dose, two-thirds of preceding.

Liquor Acidi Arsenosi.—Solution of Arsenous Acid (1 per cent.). Dose, 0.06 to 0.60 c.cm. (or *mi*-x).

Liquor Potassii Arsenitis.—Solution of Potassium Arsenite (equal to 1 per cent. of arsenic trioxide.). Fowler's solution. Dose, 0.06 to 0.60 c.cm. (or *mi*-x).

Liquor Sodii Arsenatis.—Solution of Sodium Arsenate (1 per cent. of dried arsenate of sodium). Dose, 0.06 to 0.60 c.cm. (or *mi*-x).

Liquor Arseni et Hydrargyri Iodidi.—Solution of Arsenic and Mercuric Iodide (1 per cent. each of arsenic iodide and red mercuric iodide). Donovan's Solution. Dose, 0.06 to 0.60 c.cm. (or *mi*-x).

B. P. Preparations.

Ferri Arsenas.—Iron Arsenate. Dose, 0.004 to 0.015 (or gr. $^1/_{16}$-$^1/_4$).

Arsenii Iodidum.—Arsenious Iodide. Dose, 0.003 to 0.013 Gm. (or gr. $^1/_{20}$-$^1/_5$).

Sodii Arsenas.—Dose, 0.0016 to 0.006 Gm. (or gr. $^1/_{40}$-$^1/_{10}$).

Liquor Arsenicalis.—Arsenical Solution, Fowler's Solution (1 per cent.). Dose, 0.06 to 0.50 c.cm. (or *mi*-viij).

Liquor Sodii Arsenatis.—Solution of Sodium Arsenate (1 per cent.). Dose, 0.06 to 0.50 c.cm. (or *mi*-viij).

Liquor Arsenii et Hydrargyri Iodidi.—Solution of Arsenious and Mercuric Iodides. (Same strength and dose as U. S. P. preparation.)

Liquor Arsenici Hydrochloricus.—Hydrochloric Solution of Arsenic (100 c.cm. contain 1 Gm. of arsenious anhydride). Dose, 0.12 to 0.50 c.cm. (or *mii*-viij).

Pharmacology.—A white, almost tasteless, heavy powder, containing not less than 99.8 per cent. of pure arsenic trioxide. It is soluble in 30 parts of cold water or 15 of boiling water; also in glycerin and in hydrochloric-acid solution. When thrown upon burning charcoal it volatilizes, the garlicky fumes being very poisonous. It is recognized by **Marsh's test**: by the generation of hydrogen in the presence of a solution containing arsenic, arsenureted hydrogen is produced, which leaves a dark ring on a cold plate held in its flame; this also is extremely poisonous if inhaled. **Reinsch's test** consists in adding a few drops of hydrochloric acid to the suspected solution, and immersing in it a polished plate of copper; the solution being heated, metallic arsenic is deposited upon the copper. Arsenic possesses antiseptic qualities, and preserves bodies from decay; when death occurs from its effects, it, therefore, remains for a long time in the stomach, liver, and other organs. Owing to its tastelessness and want of color, arsenous acid is frequently given with homicidal intent, but it is the most easily recognized

[1] "Annual of the Universal Medical Sciences," 1890, vol. v.

by its tests of all the mineral poisons. **Paris green,** or **Scheele's green,** is an impure copper arsenite, used for killing potato-bugs, and as a pigment in wall-papers, and is a frequent cause of poisoning.

ATOXYL.—Anil-arsenate of Sodium, is said by Fourneau (Journal de Pharm. et de Chemie, 1907, No. xxv) to be a monosodium salt of orthoarsenious acid with the formula $C_6H_5NH + As_2O < \begin{matrix} OH \\ ONa \end{matrix} 2H_2O$. It has been brought forward as a semiproprietary product in Europe with the statement that it contains 37.60 per cent. of arsenic; but Fourneau only found 29 per cent. It was originally formed by Bechamp in 1863 by heating arsenate of anilin. It is used hypodermically in the treatment of syphilis. It has been stated that several cases of poisoning have occurred after using the German product.

Cacodyle, or kakodylic acid (see **Acidum Cacodylicum**), is a white crystalline powder, soluble in water.

Physiological Action.—To the surface of the skin, if moistened, arsenic acts as an irritant, and produces inflammation and sloughing. Arsenic is readily absorbed, and is supposed to enter into combination with the red blood-corpuscles. It diminishes the elimination of carbonic acid and probably of urea.

Taken in small doses, arsenic exerts a tonic effect upon the nervous system, stimulates the circulation, and permits an increased amount of exercise to be taken without fatigue or short breathing. Large doses depress the action of the heart and diminish blood-pressure. The respiratory centre is stimulated by small and depressed by large quantities. Medicinal doses decrease, and excessive amounts increase, the metamorphosis of nitrogenous tissue. When administered for a long time, the system becomes habituated to its use and much larger doses may, in some cases, be taken without serious consequences. The arsenic-eaters of Styria can take 0.50 to 0.65 Gm. (or gr. viii-x) at a dose. It is said that but few can tolerate such large doses, and they are careful not to drink water afterward; so that absorption probably goes on very slowly, at the same time that it is eliminated rapidly by the kidneys. It is possible that the tolerance may be partly explained by heredity, as imitators of the arsenic-eaters, sooner or later, experience the toxic effects of the drug. Inflammation of the stomach is one of the results of poisoning by arsenic, even when introduced per enema or absorbed through the general surface. The urine becomes scanty, albuminous, or bloody. The skin is affected by arsenic; superficial œdema, especially of the face, appears, and may be followed by eczema, urticaria, herpes zoster, bronzing in patches, or exfoliation of the epidermis. The hair and nails may fall and conjunctivitis may occur. If the remedy is not discontinued at this time the puffiness of the eyelids and face may increase until a general anasarca is the result. Cases of idiosyncrasy have occasionally been observed in which the prolonged administration of arsenic in medicinal doses has given rise to urethritis, which gradually abated when the use of the drug was abandoned. The digestive organs are stimulated by small doses, but large ones cause gastro-enteritis, with burning pain in the epigastric region, vomiting, purging, and collapse resembling Asiatic cholera. In fact, when symptoms of this kind appear in the absence of an epidemic of cholera, they are very likely caused by arsenical poisoning, and should always excite suspicion of the administration of arsenic. Arsenical poisoning is occasionally

accompanied by paralysis of one or more extremities. According to the observation of Dr. Thomas Buzzard, the continued use of arsenic will occasionally give rise to multiple neuritis. Arsenic is eliminated from the system by the kidneys, and can be readily detected in the urine, when recently ingested. Knecht and Dearden[1] have shown that in small part arsenic escapes from the system through the hair. Their method employed was not only one of detection, but also estimation, and obtained as high a proportion of arsenic as 1 to 10,000. There is also at the present time abundant evidence to show that the fate of arsenic in the body is partly in the hair, and this fact cannot but be of the utmost importance in medicine, especially in toxicology.

The neuritis and paralysis so often observed in alcoholics may at times be due, not to alcohol, but to a contamination of arsenic in the malted beverages. The attention of the profession has recently been called to this important subject by Dr. E. S. Reynolds, of Manchester, England, who announced at the meeting of the Manchester Medical Society on November 21, 1900, that the epidemic of multiple neuritis then existing in that city was caused by arsenic in the beer drunk by those so affected; he found that the arsenical contamination was due to the use of sulphuric acid employed in the preparation of glucose being made from arsenic pyrites, the acid being contaminated with arsenous acid to the extent, in some instances, of 1.4 per cent. of its weight, the arsenized glucose carrying with it as high as 0.13 Gm. (or gr. ij) of arsenous oxide to the gallon of beer. This deplorable occurrence, it is hoped, will serve as a warning to brewers of the danger of substituting cheap and impure products for the proper ingredients. The general appearance of the patients was described[2] as frequently, but by no means always, that of persons suffering with alcoholism. Usually the patients walked with difficulty, in an ataxic manner; pigmentation of the skin in various parts of the body was observed in almost every case, chiefly of exposed parts and of the axillæ, the groins, the areolæ of the breasts, and the region surrounding the umbilicus. In many cases there was herpes, erythema, or an eruption of papules; cramps and pains resembling fulgurant pains of tabes dorsalis were common; and the soles of the feet were exceedingly tender, so that walking, besides being ataxic, was exquisitely painful. Other symptoms noted were tremors, exaggerated reflexes, diminution or absence of knee-jerk, and a condition resembling erythromelalgia; nausea and vomiting were often complained of, but in many cases there was no vomiting. The exact number of cases poisoned in Manchester alone is not definitely known, though at one time more than three hundred cases had been under observation.

The vagina also has been used as a route for the introduction of arsenic into the system, and a number of cases have been reported in which it was thus administered criminally, either in solution or in crystals. In the last century a peasant in Hungary, as reported by Mangar, poisoned three wives by introducing arsenic into the vagina after coitus. Haberda[3] reports a case of a young woman who apparently had committed suicide in this way; at the autopsy there was found acute inflammation of the surrounding organs and a paper package containing arsenic crystals was found in the vaginal

[1] *Lancet*, March 23, 1901.
[2] *New York Medical Journal*, December 15, 1900.
[3] *Centralblatt für Gynäkologie*, No. 50, 1896.

vault, imbedded in thick fibrinous exudations. The patient died with symptoms of peritonitis.

In exceptional cases of poisoning by arsenic the gastro-intestinal symptoms are not prominent, but profound collapse or stupor may be the chief manifestation and herald a speedy death. After recovery from the immediate effects of overdoses of arsenic various disorders, especially of the alimentary canal and nervous system, may occur as a result. Myelitis, peripheral neuritis, motor paralysis, hyperæsthesia, or anæsthesia are among the after-effects of this drug. A case fell under the observation of Dr. Roget in which epilepsy occurred as one of the secondary effects of the poison. Chronic arsenical poisoning is not uncommon among workmen on account of the extensive employment of this substance in the arts. A summary of the most typical manifestations of this form of toxæmia is thus given by the late Professor Taylor: "Dryness and irritation of the throat, irritation of the mucous membranes of the eyes and nostrils, dry cough, languor, headache, loss of appetite, nausea, colicky pains, numbness, cramps, irritability of the bowels attended with mucous discharges, great prostration of strength, a feverish condition, and wasting of the body."

In workmen employed in making arsenical dyes local affections are produced by constantly handling the substance. Among these effects are ulcers about the roots of the nails, papular and eczematous eruptions, and erysipelas. To these local difficulties the constitutional symptoms of chronic intoxication may subsequently be added. After death from arsenic, fatty degeneration of the heart, liver, kidneys, and other organs has been found. The temperature is depressed by toxic doses. Fly-poison, or cobalt, an impure arsenical oxide, is sometimes swallowed by mistake; so is rat-poison, made by mixing arsenic and meal ("rough-on-rats" contains 50 per cent.). Arsenic is excreted from the body by the kidneys and intestinal canal. It also escapes by way of the skin, and it has been found in different secretions, as the saliva, tears, and milk of nursing women to whom it had been administered.

As arsenical intoxication is occasionally due to wall-paper, the following test is of easy application in suspicious cases: A small piece of the paper placed in strong ammonia-water will give rise to a bluish color if arsenite of copper be present. A yellowish deposit upon a crystal of silver nitrate, moistened with a drop of the fluid, points to the presence of arsenic. Death has been caused by the ingestion of 0.13 Gm. (or gr. ij) of white arsenic. On the other hand, considerable amounts have been taken without fatal consequences, the immunity being, in all probability, due to prompt emesis and the form in which the poison was taken. Death from arsenic usually occurs within from eighteen hours to three days, but it has taken place in twenty minutes, while, on the contrary, the patient has lingered until the sixteenth to twentieth day.

Antidotes.—The antidotes to arsenous acid are the freshly-precipitated sesquioxide of iron, or the official ferri hydroxidum cum magnesii oxido, of which about 1.30 Gm. (or gr. xx) must be given for each grain of arsenic swallowed. The solution of dialyzed iron is also a convenient preparation for this purpose. Calcined magnesia and milk may be freely administered, and the stomach emptied by the stomach-pump, or by free vomiting. Oleaginous or mucilaginous drinks are also serviceable. If purging has not occurred, the bowels should be emptied by magnesium sulphate or Rochelle

salt. The case subsequently may require treatment for resulting gastric inflammation. The autopsy reveals lesions of the œsophagus and stomach, with erosions and ecchymoses, congestion of the lungs, and fatty degeneration of different organs. The arsenic may be detected not only in the contents of the stomach, but also in the urine and in the tissues, especially the liver and great nerve-centres. The antidotes to Fowler's solution are the ferric salts, especially the official solution of ferric acetate, to which a little ammonia should be added to neutralize the free acid.

Therapy. — When administered internally, arsenic has occasionally shown considerable power over morbid growths, and is the only remedy we have at our command that has any effect upon the development of cancer of the viscera. In epithelial cancer and other superficial growths arsenical paste has been employed (cinnabar, 70; dragon's blood, 22; arsenous acid, 8), but, as previously stated, it is a very painful treatment, and may only be applied to a small area at a time on account of the danger of producing toxic effects. The excessive use of an arsenical paste or powder has caused death by absorption of the poison.

Dr. Wight regards arsenic bromide as the most efficacious agent in preventing the dissemination and extension of malignant growth. In sarcoma he recommends a combination of this preparation with calcium carbonate.

In ague and chronic malarial disorders, and also as a prophylactic against malarial poisoning, arsenic is used very effectually in small doses, and may be combined with quinine and iron:—

℞ Liq. potassii arsenitis ..... | 18 to | 30 c.cm. or *m*iii-v.
Tr. cinchona comp. ..... | 7 | 50 c.cm. or f3ij.
M. Pro dosi.

℞ Sodii arsenatis ..... | 065 Gm. or gr. j.
Mass. ferri carbonatis ..... | 1 | 3 Gm. or gr. xx.
Quininæ sulph. ..... | 1 | 3 Gm. or gr. xx.
M. et ft. pil. no. xx.
Sig.: One three times a day.

℞ Arseni sulphidi ..... | 13 Gm. or gr. ij.
Aloini ..... | 065 Gm. or gr. j.
Ferri pyrophosphatis ..... | 2 | 60 Gm. or gr. xl.
M. et ft. pil. no. xx.
Sig.: One three times a day.

Dr. C. F. Bryan believes that arsenic acts as a prophylactic against scarlet fever and, perhaps, against diphtheria and influenza. The use of arsenic in pulmonary tuberculosis is advocated by Dr. Karl Hochhalt, who found that in fifty cases the appetite improved, the weight increased, and the fever diminished, while Fowler's solution was being administered. In neuralgia, arsenic frequently exercises a very happy effect, especially when given in the form of the solution of sodium arsenate. Larger doses are required for some cases of chorea, but the effect is very marked. According to Dr. William Murray, of Newcastle-on-Tyne, the most effectual method of treating chorea is by the administration of large doses of Fowler's solution. He begins by giving 1 or 1.20 c.cm. (or *m*xv-xx) three times a day, in the middle of a meal. He claims that these heroic doses may be given for a few days without disturbing the stomach, and that it cures chorea within a week. A safer method is to begin with a small dose, and increase each day until the maximum is reached; then stop for a few days, and begin again.

A course of arsenic has a valuable tonic influence in organic heart disease, and under its use dyspnœa, palpitation, and œdema improve. It also corrects intermittency of the pulse. This remedy is of service in certain forms of chronic albuminuria. Dr. Phillips has employed it with advantage for many years in albuminuria following scarlatina. Arsenic will not infrequently succeed in relieving hæmorrhoids.

It may be administered with advantage thus:—

℞ Liq. sodii arsenatis,
Fluidext. nucis vomicæ..... aa 4| c.cm. or f3j.
Elix. gentianæ .....150| c.cm. or f3v.
M. Sig. One teaspoonful in water after meals. Used in neuralgia and chorea.

Sawyer[1] highly extols arsenic in gastralgia, where pain exists when the stomach is empty and is relieved by taking food. He gives 0.0027 Gm. (or gr. $^1/_{24}$), in pill with some vegetable extract, three times daily, half-way between meals.

A pill highly extolled in the treatment of neuralgia is:—

℞ Arseni iodid.	065	Gm. or gr. j.
Ext. belladonnæ fol.		
Morphin. valerianat. ..... aa	50	Gm. or gr. viij.
Pulv. ext. gentianæ	32	Gm. or gr. v.
Pulv. ext. aconiti.....	32	Gm. or gr. v.

M. et ft. pil. no. lx.
Sig: One to three pills during the day.

Some spasmodic disorders of respiration, asthma, hay fever, and chronic catarrhal bronchitis are controlled by arsenic, and, if there is no acute inflammation, it may be used with the atomizer. Arsenic is of service in catarrhal pneumonia. Cases of periodical sneezing, dependent upon reflex action, have been cured by the use of this remedy.

In irritative dyspepsia, with morning vomiting and clean, red tongue, arsenic is of service; also in the diarrhœa coming on immediately after eating. In skin diseases arsenic is valuable in proportion to the absence of irritation or acute inflammation. In all chronic processes, especially when accompanied by desquamation or infiltration of the skin, such as psoriasis, the persistent use of small doses is often curative; also in the dry form of eczema and impetigo, as well as in pemphigus and lichen. In the vesicular or bullous eruptions of children small and repeated doses of arsenic are usually followed by speedy improvement. It is contra-indicated in the early stage of each of these affections except psoriasis. Sawyer[2] recommends arsenous acid for gastralgia given in pill form with gentian or other vegetable extract.

Prof. O. Lassar[3] gives an account of three cases of cancroid in which the internal use of arsenic was followed by a disappearance of these growths; in one case sections were made of the growth before treatment, which upon examination gave the appearance of a beginning epithelioma; the arsenic was administered in pills containing 1 milligramme, increasing the dose to the physiological limit and continuing treatment for several months. In

[1] *Lancet*, July 4, 1896.
[2] *Lancet*, July 4, 1896.
[3] *Berliner Klinische Wochenschrift*, March 11, 1901.

one patient there had not been a recurrence of the growth at the end of eight years.

Dermatitis herpetiformis and recurrent herpes are benefited by the administration of arsenic. It is generally of service also in the treatment of chronic urticaria. The internal administration of arsenic will prove of benefit in chronic scaly affections. The persistent administration of small doses of arsenic is usually of service in the small pustular and papular forms of acne, especially in cases dependent upon debility or anæmia.

The following are serviceable formulæ in the diseases referred to:—

℞ Liq. potassii arsenitis..... 4| c.cm. or f3j.
Tinct. nucis vomicæ..... 7|50 c.cm. or f3ij.
M. Sig.: From 15 to 20 drops in water three times a day.

℞ Sulphuris sublimati ..... 6|50 Gm. or gr. c.
Arseni trioxidi ..... |065 Gm. or gr. j.
M. et ft. capsulæ no. xx.
Sig.: One after meals.

In diabetes mellitus, the solution of arsenic bromide (not official), taken in Vichy water after each meal, has produced remarkable results in the hands of Clemens, probably owing to its action upon the liver.

Quinquaud has experimentally demonstrated that, in animals fed with arsenic, diabetes cannot be produced by lesion of the bulb. In disease of the liver or kidneys, especially the early stages of cirrhosis, arsenic sometimes has a very decided effect. In vomiting and diarrhœa, especially in infancy, copper arsenite in infinitesimal doses (0.0005 Gm., or gr. $^{1}/_{128}$, to water, 120 c.cm., or f℥iv, a teaspoonful being given every hour or less) has been followed by good results; but the older method of using Fowler's solution in the same way is probably better, because less poisonous than the copper arsenite, the effect being largely due to the antiseptic action of the arsenic, which acts more efficiently in the soluble form.

The vomiting of pregnancy is often remarkably relieved by the administration of a drop of Fowler's solution immediately before each meal. The same preparation is valuable in chronic gastritis (especially when it has been produced by alcohol), in chronic gastric ulcer, and cancer of the stomach. Arsenic is sometimes beneficial in chronic rheumatism. In rheumatoid arthritis Phillips testifies that under the continued use of this drug he has known the joints to return to their natural size. In angina pectoris Anstie asserted that arsenic was of decided service in mitigating the severity of attacks, especially in anæmic patients suffering from overwork and anxiety. Syphilitic affections are sometimes better treated by the combination of mercury with arsenic than by mercury alone. Donovan's solution is especially useful in old syphilitic skin lesions.

Dr. H. Smith has reported a case of secondary syphilis, in which arsenic produced a rapid improvement, after mercury and iodide of potassium had failed. An isolated case of trichinosis was successfully treated by Dr. Merrill by means of Fowler's solution in doses of 0.30 c.cm. (or *m*v) thrice daily, gradually increased until constitutional effects were produced. Previous to its administration the patient was steadily growing worse. Donovan's solution in doses of 0.60 c.cm. (or *m*x) three times a day is said to do good in gleet. Finally, in chlorosis and anæmia the tonic effects of arsenic may

well be combined with those of quinine and of iron. The usual dose of arsenous acid is 0.0027 Gm. (or gr. $^1/_{24}$), to be cautiously increased. The best method of administration is in solution. Arsenic iodide has been found extremely effective by R. St. Philippe in cases of chronic eczema, inflammation of the eyes, intestinal catarrh, and other manifestations of scrofula. From 0.30 to 1.20 c.cm. (or *m*v-xx) a day, of a 1-per-cent. solution, in cold water, of arsenic iodide were administered, with no local treatment except sterilized water. Recently he has confirmed this, after an experience of over 300 cases.

In a case of leukæmia which Dr. Drew treated by means of an arsenical solution, in ascending doses until the physiological limit was reached, the spleen, which had been greatly enlarged, became, in the course of three months, diminished in size, the proportion of white blood-corpuscles was decreased, and the number of red corpuscles was augmented. When amenorrhœa is caused by congestion of the uterus, anæmia, or chlorosis, the administration of arsenic will usually be followed by a return of the catamenial flow. Professor Renaut, of Lyons, advocates the administration of arsenic by the rectum. Three injections may be given daily, of a solution containing a third of a milligramme (gr. $^1/_{180}$) in 5 c.cm. (*m*lxxv). The treatment may be continued for months. Should any rectal irritation be caused, the addition of a few drops of laudanum will obviate it. This treatment is highly recommended by Renaut in the early stage of tuberculosis; also in diabetes mellitus, and in exophthalmic goitre.[1]

Radcliffe was the first to use arsenic hypodermically for the relief of chorea, in 1866, and since then it has been frequently used in scaly skin diseases, lymphadenomata, and nervous disorders. This method is also of advantage in the treatment of obstinate cases of malaria which have resisted the action of quinine. Very marked hypertrophy of the liver and spleen due to malaria may be reduced by the injection of Fowler's solution. Dr. Hué, of Rouen,[2] used hypodermic injections of 1 to 1000 solution of arsenous acid in inoperable cancer. In a case of epithelioma of the cheek he claims to have effected a complete cure. Planel obtained the same result in a case of cancer of the breast. This agent has also been used in several cases of recurrence of cancer; in some the progress of the disease has been distinctly retarded, in others the treatment had no effect. Hué used the following:—

R Arseni trioxidi	20	Gm. or gr. iij.
Cocainæ hydrochloridi	1	Gm. or gr. xv.
Aquæ destillatæ	90	c.cm. or f℥iij.

Of this, 1.20 to 2.50 c.cm. (or *m*xx-xl) were injected into the substance of the tumor, at intervals varying from two to eight days. In the successful case of epithelioma above mentioned Hué gave daily injections during several months.

The ointment of oleate[3] of arsenic is also a useful application in the treatment of old ulcers, epithelioma, and lupus. The following combination will be found of service in the diseases just named:—

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[1] *Nouveaux Remèdes*, April 24, 1898.

[2] *Semaine Médicale*, Nov. 6, 1895.

[3] See "Ointments and Oleates, especially in Skin Diseases," by the author. F. A. Davis, 1890.

℞ Morphinæ sulphatis		13 Gm. or gr. ij.
Zinci chloridi		32 Gm. or gr. v.
Pulveris marantæ	4	Gm. or ʒj.
Ungt. arseni oleatis	15	5 Gm. or ʒss.

M. Sig.: Apply on old muslin for several hours.

Arsenic iodide (0.25 or 0.32 Gm. to 4 Gm., or gr. iv or v-ʒj) in ointment is a valuable stimulating application in old dry eczema.

In warts, Unna advises the application of mercurial ointment containing from 5 to 10 per cent. of arsenic. E. Mansel Sympson declares that the internal administration of small doses of arsenic has a curative effect upon warts. After a week or two of this treatment the growths begin to disappear.

The cacodylate of guaiacol is a white salt, very soluble in alcohol, oil, and glycerin, but in water only 5 parts in 100. The addition of 1 per cent. of free guaiacol makes the watery solution more permanent, and acts as a local anæsthetic when the solution is used hypodermically. Introduced into medicine by Dr. Barbary, of Nice, in 1900, Dr. Burlureaux[1] has recently advocated its use in tuberculosis and in la grippe. One or two injections of 5 centigrammes reduces temperature, and ameliorates all the symptoms.

ACIDUM BENZOICUM (U. S. P., B. P.).—**Benzoic Acid** ($HC_7H_5O_2$). An organic acid usually obtained from benzoin by sublimation, or prepared artificially, chiefly from toluol. (See **Benzoinum.**)

ACIDUM BORICUM (U. S. P., B. P.).—**Boric Acid** (H_3BO_3). Formerly **Boracic Acid.**

Dose, 0.32 to 2 Gm. (or gr. v-xxx). B. P., 0.32 to 1 Gm. (or gr. v-xv).

Preparations.

Glyceritum Boroglycerini (U. S. P.).—Glycerite of Boroglycerin. Glycerinum Acidi Borici (B. P.).—Solution of Boroglyceride. (Contains 50 per cent. by weight of boroglycerin.) For external use.

Sodii Boras (U. S. P.).—Sodium Borate. Borax. Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Unguentum Acidi Borici (U. S. P., B. P.).—Boric-Acid Ointment (10 per cent., with paraffin ointment).

Borax (B. P.).—Borax, Sodium Biborate. Dose, 0.32 to 2 Gm. (or gr. v-xx).

Glycerinum Boracis (B. P.).—Glycerin of Borax (1 to 6).

Mel Boracis (B. P.).—Borax Honey (borax, 50; glycerin, 25; clarified honey, 400 Gm.).

Liquor Antisepticus (U. S. P.).—Antiseptic Solution (boric acid, 20 Gm.; benzoic acid, 1 Gm.; thymol, 1 Gm.; with eucalyptus, 0.25; peppermint oil, 0.50 Gm.; ol. gaultheria, 0.25 Gm.; ol. thyme, 0.10 Gm.; alcohol, 250 c.cm.; with sufficient water to make 1000 c.cm.). Used as a dentifrice and as an antiseptic spray for the throat and nose. May be taken internally in doses of 2 to 8 c.cm. (or f3ss-ij).

Pharmacology.—Boric acid is in transparent, colorless, six-sided plates, soluble in 25 parts of water or 15 parts of alcohol, and in 3 parts of boiling water or 5 of boiling alcohol. The alcoholic solution gives a green flame. Borax is soluble in 16 parts of cold water, but not in alcohol. The solubility of boric acid is greatly increased by the addition of borax. When a mixture of equal parts of boric acid, borax, and water are heated together a solution is obtained known as the tetraborate of sodium, which is apparently a new salt, as it is of neutral reaction. Sodium tetraborate is a white, unctuous

[1] *Bulletin Gen. de Thérapeutique.* January 23, 1906.

powder, readily soluble in water and free from caustic or toxic properties. Boric acid has a feebly-acid taste and borax a sweetish, alkaline taste and alkaline reaction. **Boroglycerin** is a combination of boric acid (62 per cent.) and glycerin. An equal quantity of glycerin added to this makes the official solution of boroglycerin. Lister's antiseptic ointment for dressing wounds is made by adding 1 part each of boric acid and white wax, to 2 parts each of paraffin and almond-oil. Borated lint or borated cotton-wool (absorbent cotton) is made by steeping the substance in a saturated solution of boric acid and allowing it to dry. **Boral,** a trade preparation, consists of equal parts of boric acid and acetanilide, in fine powder.

Physiological Action and Therapy.—Boric acid is antiseptic. The presence of borax in food notably retards the action of saliva upon starch, as shown by experiments made by C. T. Fox, under the direction of Professor Weber, of Columbus, Ohio.

Chittenden and Gies[1] found that moderate doses of boric acid (up to 3 Gm., or gr. xlv, daily) are practically without influence on proteid metabolism or upon general nutrition. The same is true of borax, up to daily doses of 5 Gm. (or gr. lxxv). Larger doses of borax from 5 to 10 Gm. (or $\overline{3}i^{1}/_{4}$-iiss) daily, have a direct stimulating effect upon proteid metabolism, and lead to increased excretion of nitrogen; also of sulphuric and phosphoric acids. They retard the assimilation of proteid and fatty foods. With very large doses there is a tendency to diarrhœa from increased secretion of mucus. Borax decreases the volume of urine, gives it an alkaline reaction, and, owing to its excretion by this channel, raises the specific gravity. Neither borax nor boric acid has any influence upon the putrefactive processes of the intestine. They are rapidly eliminated from the body (twenty-four to thirty-six hours).

Boric acid is rapidly eliminated in the urine and is said by Max Grüber to increase the elimination of urea and the quantity of urine passed. Accidents from its use are rare; but a few cases have been observed in which boric acid excited cutaneous eruptions. The eruptions which may be excited by the internal use of boric acid assume a number of forms. Erythema, papules, blebs, generalized urticaria, and confluent rubeola-like rashes have been observed. Disturbances of the nervous system have also been caused. The symptoms have been attributed to non-elimination of the acid by the kidneys. Suppuration of the ear, or running from the ear, is cured by cleansing the canal and insufflating finely-powdered boric acid. In the treatment of aural suppurations and wounds Dr. Jaenicke, of Görlitz, recommends sodium tetraborate, which is also considered as a valuable application in conjunctivitis and keratitis and is said to restrain the formation of pus. Dr. J. Harris Pierpont suggests that finely-powdered boric acid is a ready means of diagnosticating small perforations of the membrana tympani. After the external ear has been cleansed and dried the powder is blown into the canal until the membrane is completely coated. When an examination is made, a few hours subsequently, the perforation, if present, will appear as a dark or discolored spot upon a white field, the discharge, in escaping through the opening, having partially or wholly dissolved the acid. Powdered boric acid is regarded by McCandliss[2] as an excellent application

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[1] *American Journal of Physiology*, Jan., 1898.
[2] *China Medical Missionary Journal*, Dec., 1890.

to leg ulcers. It is entirely unirritating when applied to the skin, and has been used as a dressing for wounds in powder or ointment.

R. B. Wild,[1] after citing a number of cases, including some of his own, distinguishes two forms of intoxication from boric acid—one in which a large quantity of the drug is rapidly absorbed from the alimentary canal, from a serous or other cavity, or from an extensive raw surface; in these cases vomiting and diarrhœa, general depression, and partial paralysis of the nervous and muscular systems occur, and may cause death. A rash is noted in many instances, especially when the patient recovered or lived some days after the absorption of the drug. The other class of cases results from the administration of boric acid or borax in comparatively small doses for long periods, and the symptoms appear at a variable time after the commencement of the drug. In some of these cases it is mentioned that the kidneys were diseased, and the author gives, as a possible reason for the immunity to the injurious effects of boric acid, its very rapid elimination by healthy kidneys.[2] Furthermore, it is possible that cases of intoxication occur more frequently than is at present recognized. Boric acid may unwittingly be taken in food and cause a toxic skin-eruption which may be mistaken for eczema, psoriasis, or exfoliative dermatitis. It may be noted that a 1 to 500 solution corresponds to 1.13 Gm. (or gr. xviiss) per pint of the acid, a very large dose for an infant on milk diet and one likely in some cases to produce disturbance of the alimentary canal. It should also be ascertained that the milk ordered in cases of kidney disease is free from excess of boric acid or borax. The use of boric acid or the borates in surgery and their internal administration ought to be carefully guarded in patients with diseased kidneys, and immediately discontinued on the appearance of dermatitis or other toxic symptoms. In suspected cases examination of the urine may afford valuable evidence of the presence of the drug.

A solution of boric acid is an agreeable application in conjunctivitis, and is very efficient in the treatment of burns, applied upon lint or absorbent cotton. The saturated solution is used in various chronic, scaly, and parasitic skin eruptions, and is the best remedy for bromidrosis of the feet or fetid perspiration. Among the beneficial combinations are:—

℞ Acidi borici ..... 2| Gm. or ʒss.
Glycerini,
Tinct. opii ..... aa 15| c.cm. or fʒss.
Aq. camphor. ..... 30| c.cm. or fʒj.
M. Sig.: Ten drops to be instilled into the ear for earache. (Dr. Prout.)

℞ Acidi borici,
Bismuthi subnit. ..... aa 12| Gm. or ʒiij.
M. Sig.: For running from the ear and in excessive and fetid perspiration.

℞ Acidi borici ..... 8| Gm. or ʒij.
Pulv. zinci carb. imp..... 15|5 Gm. or ʒss.
M. Sig.: In acute eczema and erythema.

℞ Acidi borici ..... 4| Gm. or ʒj.
Aquæ hamamelidis dest. .....120| c.cm. or fʒiv.
M. Sig.: Use in fetid perspiration and in an oily state of the skin.

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[1] *Lancet*, No. 3932, p. 23.
[2] *Merck's Archives*, Jan., 1899.

In pharyngitis Dr. Capart prescribes the following combination:—

℞ Sodii boratis	4	Gm. or 3j.
Sodii salicylatis	2	Gm. or 3ss.
Decoctionis althææ	180	c.cm. or f℥vj.

M. Sig.: To be given in divided portions through the day.

Whitla, Keegan, and others have employed boric acid in typhoid fever with good results. The temperature was lowered and the diarrhœa checked. Dr. Tortchinsky[1] has used this remedy in 240 consecutive cases of typhoid fever, and reports very favorably of its action. It is stated that the course of the disease was considerably shortened and that complications were very rare. The effect of the boric acid was enhanced, in the late stages accompanied by cerebral symptoms and in relapses, by a combination with quinine. The same writer has obtained equally satisfactory results from the use of boric acid in the summer diarrhœa of children.

Good results have been obtained in erysipelas, even of the phlegmonous form, by the application of lotions containing this remedy.

Borax in substance, mixed with white sugar, is applied to aphthous sore mouth in infants. Aufrecht recommends the internal administration of borax in the stomatitis of elderly and debilitated persons in whom the disease extends to the œsophagus and stomach, causing dysphagia and defective nutrition. A piece of borax of about 0.13 to 0.20 Gm. (or gr. ii or iij) placed in the mouth is said to be useful to speakers and singers by producing salivation and relieving hoarseness; its solution is a cooling application to superficial inflammations of the skin, and for pityriasis versicolor and seborrhœa of the scalp, or dandruff.

The late Dujardin-Beaumetz used the following as a favorite prescription for a dentifrice:—

℞ Acid. borici	25	Gm. or 3vi¹/₄.
Phenolis liquefacti	1	Gm. or gr. xv.
Thymol.	25	Gm. or gr. iv.
Aquæ	828	c.cm. or Oi³/₄.

M. et adde:—

Sp. menthæ	60	c.cm. or *mx*.
Sp. anisi	9	25 c.cm. or f3iiss.
Cocci.	q. s.	ad colorand.
Sp. vini rect.	90	c.cm. or f℥iij.—M.

The above author lays stress upon the importance of attention to the mouth, in many diseases, but especially in diabetes mellitus, in order to avoid lesions of the mucous membrane, gums, and teeth.

A lotion containing borax may be used in order to allay the itching of urticaria and paræsthesia. Internally, borax, in 1.30 Gm. (or gr. xx) doses, relieves irritable bladder and reduces the acidity of the urine. It has, in some instances, given encouraging results in epilepsy. The general tendency of borax is to diminish the number of attacks. It will sometimes succeed in cases which potassium bromide has failed to relieve. A combination of the two drugs has disappointed expectation. It is recommended to begin with doses of 0.50 to 1 Gm. (or gr. viiss-xv) and rapidly increase the amount until the limit of tolerance or a decided effect upon the disease is produced. Professor Mairet, of Montpelier, states that when daily doses of 8 Gm. (or 3ij) are insufficient to hold the attacks in check it is to be feared that larger

[1] *British Medical Journal*, Jan. 14, 1893.

doses will prove no more successful. When the paroxysms have been restrained, he advises the reduction of the amount to about 4 Gm. (or 3j) *per diem*. Among the disadvantages of the prolonged administration of borax are salivation, impairment of appetite and digestion, diarrhœa, emaciation, swelling of the face, œdema of the lower extremities, cutaneous rashes, conjunctivitis, fissures of the lips, fall of the hair, and alterations in the nails.

According to Dr. G. Lemoine, a blue line, resembling that of lead poisoning, may form upon the gums after the prolonged use of borax.

Gowers has, when administering borax in epilepsy, seen psoriasis develop in several instances, and is disposed to attribute the disease of the skin to the influence of the drug. Both psoriasis and eczema have been attributed by other writers to the ingestion of borax. Borax is said to be better borne when administered in glycerin instead of aqueous solution, or when intestinal antisepsis is conjoined. Dr. Ch. Féré, after an experience of six years with borax in epilepsy, regards it as distinctly inferior to the bromides in efficacy. The renal trouble excited by prolonged use of the drug does not always subside on suspension, and one case is mentioned which terminated fatally from uræmic coma. When the epileptic attacks are nocturnal, a portion of the drug should be given during the night. In order to cover the taste of borax M. Gay recommends solution in an infusion of licorice with the addition of a little glycerin; in sweetened milk and strong coffee; or in syrup of orange-peel with julep. Syrup of orange is said to be the best vehicle. Professor Lashkevich considers the borate of ammonium of service in phthisis. It is said to reduce the expectoration and, in some cases, the fever. He combines it with conium, hyoscyamus, or some other sedative. Dr. Golding-Bird asserts that borax cannot be employed with impunity in women, as it has a stimulant action upon the uterus, and states that in two instances he has seen it produce abortion. Some have employed borax for the purpose of exciting uterine contractions in protracted cases of labor. It has also been administered in amenorrhœa and dysmenorrhœa.

Dr. Sacaze, of Montpelier, reports an excellent result from the use of borax in a case of paralysis agitans. It was first given in 0.25 Gm. (or gr. iv) doses three times a day. After a few days the dose was gradually increased to double that quantity. Improvement was rapid.

Several cases of poisoning, some of them fatal, have been reported, apparently due to the local application of boric acid or its solutions to internal cavities: the vagina or stomach. The symptoms were reduction of temperature, depression of spirits, sickness of the stomach, feeble pulse, and, in some instances, hiccough and ecchymoses. The mind usually remained clear, but coma sometimes occurred.

Solution of boroglyceride (50 per cent.) is a pleasant and efficient application for conjunctivitis, pharyngitis, and as a dressing for wounds and granulating surfaces, having the important advantage of not being poisonous. It is especially recommended for the local treatment of diphtheria. Boroglyceride ointment, made by adding to it unguentum aquæ rosæ, is a pleasant application for sunburn, pruritus, and other skin affections. Boric-acid ointment (in lanolin or zinc ointment, 1 to 6) is used as a dressing for wounds and ulcers. The solution of boroglyceride is a valuable application in chronic eczema of the palms of the hands and the soles of the feet. It is also useful in subacute and chronic eczema of the genital organs, especially when the scrotum is invaded. It can be prescribed with witch-hazel.

The addition of borax is said to increase the laxative effect of glycerin suppositories.

ACIDUM CACODYLICUM.—**Cacodylic,** or **Dimethalarsenic, Acid** is a white crystalline powder, odorless, soluble in water, and containing 54.4 per cent. of metallic arsenic, which is equivalent to 71.4 per cent. of arsenic oxide. Cacodylic acid and sodium cacodylate have lately been occupying the attention of Continental investigators as substitutes for the usual preparations of arsenic on account of being less toxic in their effects. The cacodylates of potassium, magnesium, lithium, quinine, iron, guaiacol, and mercury have also been introduced.

Dr. Danlos,[1] of Paris, France, made a second report of his investigations with the use of the sodium cacodylate before the Paris Medical Society on June 16, 1900. He has treated some sixty cases of psoriasis, with good results, although he has to note a tendency to relapse, the method of administration being by hypodermic injections. Internally this author has used cacodylic acid with good results in lupus erythematosus, and in tuberculosis of the skin.

Dr. M. H. Billet,[2] attached to the military hospital at Constantine, Algeria, reports thirteen cases of malarial cachexia more or less pronounced that had been treated with cacodylate of sodium. This drug following immediately upon treatment by quinine, had restored the red blood-cells from about 3,500,000 per millimetre to normal, in the space of from fifteen to twenty days. The number of injections was from four to six, at intervals of three or four days, the dose employed being 0.23 Gm. (or gr. iii $^{3}/_{4}$) for each injection. The hæmoglobin proportion had been raised simultaneously with the increase of red blood-corpuscles. It has also been noted that the offensive garlic smell of the breath, when given internally, is obviated by hypodermic administration.

Dr. William Murrell, of London, reports toxic neuritis and other bad results, from doses of 0.6 Gm. (or gr. j) three times a day. He considers it a dangerous drug.

ACIDUM CAMPHORICUM (U. S. P.)—(See **Camphora.**)

ACIDUM CARBOLICUM (B. P.).—**Carbolic Acid. PHENOL** (U. S. P.). (C_6H_5OH).

Dose, 0.03 to 0.13 Gm. (or gr. ss-ij).

A constituent of coal-tar, obtained by fractional distillation, and subsequently purified.

ACIDUM CARBOLICUM LIQUEFACTUM (B. P.).—**Liquefied Carbolic Acid.**

Contains 10 parts of water to 100 parts, by weight, of phenol.

PHENOL LIQUEFACTUM (U. S. P.).—**Liquefied Phenol.**

Contains 90 per cent. phenol, with 10 per cent. water.

Preparations.

Glyceritum Phenolis (U. S. P.).—Glycerite of Phenol (20 per cent.).

Glycerinum Acidi Carbolici (B.P.).—Glycerin of Carbolic Acid (20 per cent.).

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[1] "*Bulletins et Mémoires,*" vol. xvi, p. 588.

[2] *New York Medical Journal,* Aug. 25, 1900.

Sodii Phenolsulphonas (U. S. P.).—Sodium phenolsulphonate. Sodii Sulphocarbolas (B. P.). Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Unguentum Phenolis (U. S. P.), Unguentum Acidi Carbolici (B. P.).—Ointment of Phenol (U. S. P., 3 per cent.). Carbolic Acid Ointment (B. P., 4 per cent.).

Trochiscus Acidi Carbolici (B. P.).—Phenol Lozenge (0.065 Gm., or gr. j, with Tolu basis).

Suppositoria Acidi Carbolici (B. P.).—Phenol Suppositories. Each contains 0.065 Gm. (or gr. j) with white bees-wax and cacao-butter.

Zinci Phenolsulphonas (U. S. P.), Sulphocarbolate (B. P.).—Phenolsulphonate of zinc. Dose, 0.06 to 0.30 Gm. (or gr. i-v).

Pharmacology.—Liquefied phenol is a liquid obtained during the distillation of coal-tar between the temperatures of 180° and 190° C. (356° to 374° F.). What is called crude carbolic acid is distilled at a somewhat lower temperature, and contains also cresylic acid and other substances which render it unfit for medicinal use, except as a disinfectant for drains, etc. A mixture of coal-tar constituents has, under the name of saprol, been proposed as a cheap disinfectant. **Saprol** is a dark-brown, oily substance. It floats upon the surface of water, which extracts from it carbolic acid, cresol, and other soluble products of coal-tar. In 1-per-cent. solution, saprol is an energetic agent, and is well adapted to the disinfection of dejecta in barracks, prisons, and schools. It must be borne in mind when using this fluid that it is of an inflammable nature.

Pure carbolic acid is crystalline at ordinary temperatures, and at first is colorless, but reddens after exposure to the air. It has a characteristic odor and pungent taste; it is very soluble in all the usual menstrua, having the peculiarity of being liquefied by 5 per cent. of water; but the further addition of water produces turbidity until the proportions are reversed (1 to 20), when it remains permanently clear and is not affected by further dilution. It resembles creosote in its disinfectant properties, but differs from it by being converted into picric acid when nitric acid is added to it; whereas, with creosote, nitric acid forms oxalic acid. Resorcin is also of a similar character, but is in the form of a powder. Both creosote and resorcin will be considered separately.

The following unofficial preparations are sometimes used:—

Unofficial Preparations.

Aqua Acidi Carbolici (8 Gm. in 473 c.cm. of water, or ℥ij in Oj). Dose, 4 to 7.50 c.cm. (or f℥i-ij); also as a wash, gargle, or spray.

Carbasus Acidi Carbolici (gauze, containing carbolic acid, 1; resin, 5; paraffin, 7 parts).

Oleum Acidi Carbolici (1 in 20 of olive- or cotton-seed- oil).

Carbolic-Acid Camphor.—Dissolve 9 parts acid in 1 of alcohol, and mix with 25 parts camphor, forming a clear, oily solution.

Liquor Sodii Carbolatus (N. F.).—Solution of Carbolate of Soda (carbolic acid, 12.60 Gm., or gr. clxxxviij; caustic soda, 2 Gm., or gr. xxxj; water, 120 c.cm., or f℥iv.) For external use, properly diluted. Phénol-sodique.

Liquor Sodii Boratis Compositus (N. F.).—Dobell's Solution (borax and sodium bicarbonate, each, 8 Gm., or ℥ij; carbolic acid, 1.55 Gm., or gr. xxiv, in water; 473 c.cm., or Oj). For external use in spray for nose and throat.

Tribromophenol.—A compound of Bromine with Carbolic Acid with strong bromine odor. In the form of soft, white needles; used as an antiseptic externally and internally. Dose, 0.20 Gm. (or gr. iij).

Parachlorphenol. As an antiseptic.

Calcium Carbolatum.—Carbolated Lime. For disinfecting purposes.

Physiological Action.—Carbolic acid and its preparations are distinguished by their destructive action upon the lower forms of life, but, owing

to their tarry smell and toxic effects, they cannot be used for preserving food, and are not popular in the household. When applied to the skin, carbolic acid causes irritation, and sometimes sloughing. Gangrene sometimes follows the use of carbolic acid as a surgical dressing. According to the observations of Dr. E. T. Reichert, this result is most apt to be caused by the use of moist applications and occurs especially in weak subjects, women and children. According to some reported cases, the presence of chronic alcoholism or diabetes seems to favor the occurrence of this accident. Carbolic acid is a local anæsthetic. It is also readily absorbed through the skin, and toxic effects have been produced in this way, although much more frequently by the absorption through the raw surface of a recent wound. Two cases of coma due to the application for a variable time of a 5-per-cent. solution have been reported by R. Clement Lucas and W. Arbuthnot Lane. The urine is diminished in quantity, and on standing acquires an olive-green color; this is generally the earliest symptom of intoxication. We also notice loss of appetite, nausea, vomiting, frothy salivation, difficulty in swallowing, and nervous symptoms. The pupils are contracted and the functions of the brain and spinal cord are affected, suspended reflexes and impaired sensibility and motility being observed. Large doses exert a depressant influence upon the circulation, and after lethal amounts the heart stops in diastole. Death occurs from respiratory paralysis; the temperature is at first increased, but afterward is reduced. In severe cases there is shock, great pallor, and sudden death. At the autopsy the drug may be recognized by its penetrating odor; evidences of corrosive action may be seen if taken in concentrated form, but even in small quantities it produces gastritis. As elimination takes place principally by the urine, the kidneys may be congested or inflamed; the blood is dark and imperfectly coagulated.

According to the observation of Dr. W. J. Wilkinson, the number of red blood-corpuscles is reduced, but the percentage of hæmoglobin remains unaltered. Zwaardemaker has shown that rats and cats are particularly susceptible to the action of carbolic acid. After a poisonous dose death sometimes comes on with great rapidity. In rare cases it is delayed for several hours or days. The fatal dose varies within wide limits, the minimum being rather more than 4 Gm. (or 3j).

Treatment of Poisoning. — When carbolic acid has been swallowed prompt treatment is required. The soluble sulphates (soda or magnesia) are the best antidotes, but the liquor calcis saccharatus, or syrup of lime, is also useful, if at hand. Alkalies, soap, albumin, flour and water may be given, and the stomach washed out with the stomach-pump. Oils should not be given, as they favor absorption. The bowels should be freely opened with magnesium, or sodium, sulphate. Collapse is relieved by hypodermic injections of atropine, by hot applications, arterial stimulants, and friction. The soluble sulphates should be administered in small doses for several days, in order to remove the carbolic acid from the system. Professor Carleton, of New York, states that vinegar is an excellent antidote to phenol. When applied to a cutaneous or mucous surface which has been burnt by the acid the characteristic whitish appearance produced by the caustic at once disappears and subsequent scarring is to a large extent prevented. Vinegar is also said to be equally good as an antidote when the acid has been taken into the stomach, and it is recommended that the patient should as soon as possible drink some vinegar mixed with an equal part of water, after which other

measures may be taken to more fully counteract the poison. Drs. Phelps and Powell state that alcohol is an absolutely safe and sure specific against the escharotic action of concentrated carbolic acid. Dr. Gross, of Fort Wayne, further suggests the use of alcohol internally as an antidote for carbolic-acid poisoning. Cases successfully treated by alcohol given freely, both by the mouth and hypodermically, have been reported by Dr. Kelly, of Brooklyn, and Dr. Hair, of Bridgeport, Conn.[1] As cases of poisoning by this agent are becoming quite common, it has been suggested that every physician should keep on hand sulphate of soda, which is a prompt and safe antidote.

Therapy.—The antizymotic and antiseptic qualities of liquefied phenol have been largely utilized in surgery, although it has now been nearly superseded by the solutions of mercury, which have no offensive odor. Formerly the spray of carbolic water was considered an indispensable feature of the Listerian method, but this has been found to be unnecessary and has been abandoned, as asepsis can be secured without it. The solution is still used as a detergent and as an application upon dressings. In the treatment of carbuncle or malignant pustule, after incision and scraping, the application of pure carbolic acid not only acts as an antiseptic, but also as a local anæsthetic, relieving pain.

Dr. Oscar H. Allis, of Philadelphia, and Dr. B. F. Gardner, of Bloomsburg, Pa., apply undiluted carbolic acid in the treatment of wounds and burns. The tissues turn white immediately after its application and are then cleansed by douching with sterilized water. They have witnessed from its use in this manner neither shock nor systemic absorption. It also exerts an hæmostatic effect, especially upon the capillary vessels.[2] Czerny[3] reports three cases in which carbolic-acid solution was applied to the fingers and gangrene resulted. In two of the cases, a 3-per-cent. solution was applied, but it was kept on for several days. The duration of the application is more important than the concentration. Dr. Housell[4] has collected forty-eight cases of carbolic-acid gangrene and calls attention to the fact that it has been caused by solutions as weak as 1 or 2 per cent. He warns physicians to discard its use as a dressing for the extremities in all strengths. Carbolic-acid camphor, being free from offensive odor, may be used as a substitute for the pure acid. In weak solutions carbolic acid has been used as a parasiticide in various forms of tinea; and it has also been used topically for the prevention of pitting from small-pox. An ointment containing carbolic acid and camphor has proved of service also in mitigating the pruritus accompanying variola. In the treatment of burns, in the form especially of carbolized oil, it is much employed. In acute vesicular eczema, erythema, and in dermatitis, especially from various poisonous substances, the author has employed this combination with great service:—

℞ Phenolis liquefacti	38	Gm. or gr. vj.
Pulveris zinci carb. imp.	31	Gm. or ʒj.
Liq. calcis, Glycerini aa	90	c.cm. or fʒiij.

M. Sig.: Shake well, and mop frequently over the surface.

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[1] *The Medical Bulletin*, Feb., 1900, p. 57.

[2] See paper by Dr. Oscar H. Allis, on "Carbolic Acid Used in Full Strength in Surgery," in *Medical Bulletin*, Jan., 1894, p. 4.

[3] *Müchener medicinische Wochenschrift*, April 20, 1897.

[4] *Beiträge zur klinische Chirurgie*, B. 19, H. 3.

An ointment containing carbolic acid, sulphur, and camphor is most effective in many pruritic diseases of the skin, especially papular eczema, psoriasis, lichen, and urticaria (or nettle-rash):—

℞ Phenolis liquefacti ..... | 32 Gm. or gr. v.
Sulphuris subl. ..... 2 | Gm. or ʒss.
Camphoræ ..... | 65 Gm. or gr. x.
Ungt. zinci oxidi ..... 31 | Gm. or ʒj.

M. Sig.: Apply frequently to the irritable surface.

Lotions containing carbolic acid also allay the itching which accompanies jaundice.

In the vulvitis or leucorrhœa of young girls lotions or injections of carbolic acid in the strength of 5 parts to 1000 of water are beneficial, pads of lint saturated in the same solution being used to separate the inflamed parts in the intervals. The gonorrhœa of females has also been successfully managed by the application once or twice a day of tampons moistened with the following mixture:—

℞ Phenolis liquefacti ..... 1 | Gm. or gr. xv.
Alcohol. vel sp. odorat. ..... 30 | c.cm. or fʒj.
Aquæ ..... 75 | c.cm. or fʒiiss.—M.

Scabies has been cured by friction with a 1-to-15 carbolized oil.

Internally, carbolic acid, sometimes, rather unexpectedly produces symptoms of poisoning, which fact restricts its use. In fermentation accompanying flatulent dyspepsia and in dilated stomach, carbolic acid will check the process and relieve the symptoms. It is useful in irritable vomiting, given frequently in broken doses. The author suggests the following prescriptions in the variety of dyspepsia referred to:—

℞ Phenolis liquefacti ..... | 25 Gm. or gr. iv.
Pulv. aromatici ..... | 75 Gm. or gr. xij.

M. et ft. pil. no. xij. In capsulæ duris.
Sig.: One before meals.

℞ Phenolis liquefacti ..... | 32 Gm. or gr. v.
Syrupi acaciæ,
Aquæ cinnamomi ..... aa 45 | c.cm. or fʒiss.

M. Sig.: One teaspoonful before meals.

Carbolic acid is also of service in the treatment of diarrhœa. It has been used in pill form in the treatment of tape-worm. It is part of the so-called specific treatment of typhoid fever in extemporaneous combination with tincture of iodine (1 to 2 of iodine) in doses of 0.12 to 0.18 c.cm. (or *mii-iij*) every three or four hours, given in mint-water. The acid has been given in typhoid fever unassociated with iodine. Surgeon R. H. Quill, of the British army, has used in typhoid fever a combination of carbolic acid and chloroform (the proportion of acid to spirit of chloroform being as 3 to 10), and gives the most favorable reports of this method. In puerperal septicæmia, alone or alternated with quinine, it has been thought to answer a good purpose. Carbolic acid has been recommended by some writers as a valuable prophylactic against scarlet fever. In offensive breath, the cause may be in the mouth, throat, or bronchi, and in any of these cases the use of the steam-atomizer with a 5-per-cent. solution of carbolic acid will often relieve the patient very promptly. Caries of the teeth may be relieved by a

mouth-wash containing carbolic acid or phénol-sodique, well diluted. The same applied with a brush or atomizer has been used in diphtheria and various forms of sore throat. Weak solutions are used in hay fever, chronic nasal catarrh, coryza, and influenza, and afford marked relief; the one known as Dobell's solution is widely used for the purpose, and for cleansing the nostrils. It is the liquor sodii boratis comp. of the National Formulary.

Subcutaneous injections of a 2-per-cent. solution have been made for checking the progress of erysipelas, and parenchymatous injections into the lungs in pulmonary phthisis. In the early stage of furuncle, and in enlarged lymphatic glands, the parenchymatous injection of the same solution often proves effectual in preventing the formation of pus. The same method has been employed with success in the treatment of chronic synovitis, and it has proved of service in certain forms of functional spasm, accompanied by localized pain, the injection being made at the painful spots. Cases of tetanus have been successfully treated by the subcutaneous injection, conjoined with warm baths and enemata containing chloral and potassium bromide.

Dr. F. E. Place has treated successfully tetanus in horses by hypodermic injections of pure carbolic acid. His method is to inject in the neighborhood of the neck and shoulders 4 Gm. (or 3j) every two hours, for the first thirty-two hours of treatment, and less frequently later. A large swelling appears at the site of the injections, but disappears in about fourteen days. Sometimes there is a loss of hair over the spots, but it is not permanent. He has never administered less than 64 Gm. (or 3xviss) in a successful case.[1] Nietert and Amyx[2] have reported 4 cases of tetanus in the human subject treated by injections of 2-per-cent. solution of carbolic acid under the skin in the neighborhood of the wound. The patient who received the largest quantity was the only one to recover. In each case chloral-hydrate and potassium bromide were given simultaneously in large doses. The case which recovered received 17.20 Gm. (or gr. cclxvij) in eight days, of which 6.5 Gm. (or gr. c) were given in the first twenty-four hours, without untoward effect of any kind.

Dr. Flavel Woods,[3] of Philadelphia, reported recently a satisfactory recovery from tetanus by means of large doses of carbolic acid. This method was introduced by Baccelli. Babès[4] speaks of it in very high terms, and says that the statistics of the antitoxin treatment do not show any better results. Babès injected 0.50 Gm. (or gr. viiss) of a $^1/_2$-per-cent. solution along the spinal column every two hours. Arcoli injected a 2- or 3-per-cent. solution in small doses, the patient receiving 0.32 Gm. (or gr. v) a day. The Accademia Medica, of Rome, published these statistics: One death in 30 cases with Baccelli's treatment; 8 deaths in 40 with Tizzoni's serum; 4 in 11 cases with Behring's serum No. 1; 2 in 9 cases with Behring's serum No. 2. Lieutenant-Colonel W. G. H. Henderson[5] reports success with the carbolic-acid treatment of tetanus in both man and animals. Of 20 patients treated three times a day with injections of 0.13 Gm. (or gr. ij) of carbolic acid to 1.20 c.cm. (or *m*xx) of water, 7 recovered. Kitasato has demonstrated that

[1] *Lancet*, Feb. 24, 1900.
[2] *St. Louis Medical Review*, Dec., 1899.
[3] Editorial in *Medical Record*, Oct. 21, 1899.
[4] "Twentieth Century Practice of Medicine."
[5] *Lancet*, June 3, 1899.

carbolic acid acts as an anæsthetic, then as an antiseptic, and as an antidote to the toxin of tetanus.

J. M. Atkinson recommends large doses of carbolic acid hypodermically in treating the bubonic plague, and reports a successful instance of its use.[1]

Subcutaneous injections of carbolic acid were found very effective by Skultecki in 2 cases of severe erysipelas and 1 of septic puerperal fever; all recovered promptly, and he recommends the treatment as strongly as it has already been lauded for tetanus and anthrax. The erysipelas patients received seventy-two to eighty-four injections, a total of 1.44 to 1.68 Gm. phenic acid (or gr. xxi$^{3}/_{4}$-xxvj), in a 2-per-cent. solution, 1 c.cm. (or *m*xv) every four hours. The puerperal fever was treated with 0.38 Gm. (or gr. vj) of phenic acid every three hours, the first day, and afterward with 0.30 Gm. (or gr. ivss) every four hours, for a week, when the cure was complete.[2]

A. Strubell reports a severe case of gangrenous and necrotic anthrax spreading from the tip of the nose, with chills, fever, etc., completely cured with scarcely a scar, by frequent injections of a 3-per-cent. solution of carbolic acid, a total of 400 Pravaz syringefuls in eighteen days, combined with copious stimulants, warm baths, and hot cataplasms at a temperature of 50° to 55° C., applied locally every ten minutes, night and day. The growth of the anthrax bacillus is checked at 40° and permanently arrested at 42°. Cultures from the nose were very virulent, but no bacilli were found in the blood.[3]

Ziemssen recommends in tonsillitis the injection into the substance of the gland of 0.50 c.cm. (or *m*viij) of a 2-per-cent. solution. Relief is rapid, often after only a single injection has been made. As a prophylaxis against frequent recurrent attacks of tonsillitis, gargling the throat with a carbolized alcoholic solution has been advised. The pure acid (1 to 1.30 Gm., or gr. xv-xx) has been used by Levis as an injection into the tunica vaginalis, in cases of hydrocele, with successful results. In hæmorrhoids, carbolic acid, either pure or diluted with oil, has been employed with satisfactory results; but there have been some accidents. It has also been recommended in weak solution for the treatment of ascarides by enema, but the danger of absorption is too great for its use in this way; it may, however, be applied externally, as it is an excellent antipruritic.

The vapor of carbolic acid may be inhaled for whooping-cough or phthisis, in the place of the spray, by placing a few drops upon some absorbent cotton in an inhaler.

Dr. H. Ernest Schmid relies entirely, in every stage of whooping-cough, upon the use of a spray composed as follows:—

℞ Phenolis liquefacti	38	Gm. or gr. vj.
Menthol (4-per-cent. sol.)	15	c.cm. or f℥iv.
Cocain. hydrochlor. (3-per-cent. sol.	11	c.cm. or f℥iij.
Glycerin.	4	c.cm. or f℥j.
Aq. laurocerasi q. s. ad	30	c.cm. or f℥j.—M.

The solution is used by means of an atomizer every third hour, the nozzle of the instrument being directed as far as possible into the mouth

[1] *Lancet*, Dec. 9, 1899. See also article on the "Bubo Plague," by author, in revised edition of "Reference Hand-book on the Medical Sciences." William Wood & Co., New York, 1900.

[2] *Semaine Médicale*, May 25, 1898.

[3] *Münchener medicinische Wochenschrift*, Nov. 29,

of the patient. The use of a weak solution of carbolic acid by atomization, combined with its internal administration, is of service in pulmonary gangrene. In the septic diseases,—small-pox, septicæmia, puerperal fever, etc.,—the phenolsulphonates have been used with asserted success. In typhoid fever Dr. Waugh has had good results from zinc phenolsulphonate, in doses of 0.13 to 0.20 Gm. (or gr. ii-iij), four or five times a day. It has the advantage, over the carbolic acid and iodine treatment, of being less depressing to the heart and less injurious to the kidneys.

Prof. M. Charteris, of Glasgow, believes that pure carbolic acid yields good results in the treatment of typhoid fever. He gives it in the form of a pill containing 0.16 Gm. (or gr. iiss) of pure acid made up with some innocuous powder and covered with keratin, for the purpose of delaying solution until it has passed into the bowel. He is also of the opinion that it may be useful as a prophylactic and therapeutic agent in cholera, and that it might, with advantage, be tried in diphtheria in doses of 0.13 Gm. (or gr. ij) every two hours.

Magnesium phenolsulphonate is said by Dr. G. Tarozzi to be an efficacious laxative and intestinal antiseptic in doses of 1 to 2 Gm. (or gr. xv-xxx).

Parachlorphenol—obtained by the action of chlorine on phenol—is said by Girard, of Beine, to be more stable, energetic, and constant in action than other drugs and its toxicity is much less than mercury, cresol, or phenol. Subcutaneous injections of 1 Gm. (or gr. xv) per kilogramme of body-weight are required to form a toxic dose for a dog or rabbit. A 2-per-cent. solution kills the spores of anthrax in an hour, whereas a 5-per-cent. solution of phenol requires twenty days. It forms a valuable antiseptic dressing for wounds or for cleansing surgical instruments.

Phenosalyl.—Combinations of antiseptic substances have often been proposed for the purpose of securing increased action, lessened toxicity, greater solubility, etc. Dr. J. de Christmas, of the Pasteur Institute, of Paris, has devised a mixture which he terms **Phenosalyl**, the formula of which is as follows:—

Phenol	90 parts.
Lactic acid	20 parts.
Salicylic acid	10 parts.
Menthol	1 part.

This forms a clear, syrupy liquid, which partially crystallizes at low temperatures, but upon the addition of a small quantity of glycerin, a clear solution results. This will not again crystallize and readily dissolves in warm water, alcohol, and ether. In cold water it is soluble to the extent of 7 per cent. Experiments have shown that phenosalyl is considerably less poisonous than carbolic acid. It has been used in 1-per-cent. solution for the disinfection of hands and instruments, for irrigations, etc. A solution of the same strength proved rapidly curative in a case of impetigo, while 2- to 5-per-cent. phenosalyl pencils were beneficial in endometritis and urethritis. Phenosalyl has been advantageously used as an antiseptic in obstetric cases. A 2-per-cent. solution injected into the bladder was productive of excellent results in purulent cystitis. An ointment of 1 part of phenosalyl to 100 or 160 parts of vaselin was successfully employed by Dr. Berger in blepharadenitis and a 0.2- to 0.4-per-cent. aqueous solution in different forms of conjunctivitis. Scheurlen and Bechmen, a few years ago, published the re-

sults of experiments proving that the germicidal action of carbolic acid is decidedly increased by the addition of sodium chloride. A solution of 1 per cent. of carbolic acid with 24 per cent. of common salt gave better results than 6 per cent. solution of carbolic acid in plain water.

ACIDUM CHROMICUM (B. P.).—**Chromic Acid** (CrO_3)
CHROMII TRIOXIDUM (U. S. P.).—**Chromic Trioxide.**
It should contain not less than 90 per cent. of chromic anhydride.

Preparations.

Potassii Dichromas (U. S. P., B. P.).—Potassium Dichromate. Dose, 0.006 to 0.012 Gm. (or gr. $^1/_{10}$-$^1/_5$).

Liquor Acidi Chromici (B. P).—Solution of Chromic Acid (25 per cent. of CrO_3).

Pharmacology.—Chromic acid occurs in the form of small, crimson, needle-shaped crystals, deliquescent and very soluble in water. They should not be added to alcohol, as mutual decomposition takes place, sometimes explosively. An explosion results instantly from a mixture of 1 part of chromic acid with 2 parts of glycerin. For the same reason chromic acid should never be combined with spirit of nitrous ether.

Physiological Action and Toxicology. — On account of its marked affinity for water and its contained oxygen, chromic acid rapidly destroys tissues, forming an eschar, and it is a powerful antiseptic. In solution (from 5 to 20 per cent.) it acts as a caustic. When swallowed it is a corrosive poison, and requires prompt treatment by demulcents and alkalies, with irrigation of the stomach. If death does not occur at once from shock, it may result from inflammation and sphacelation of the mucous coats of the stomach. Workmen in factories where chromic acid is used are liable to have perforation of the nasal septum from the local action of the acid applied accidentally upon the fingers. Eczema of the hands is liable to occur in those engaged in making the bichromate solution used for dyeing purposes. Cloth dyed with this material is apt to produce ulceration of the integument. The electropoion fluid (Liquor Electropoeicus, N. F.), or **battery-fluid**, contains potassium dichromate in powder, 186 Gm. (or ℥vi) ; commercial sulphuric acid, 180 c.cm. (or f℥vj); cold water, 1419 c.cm. (or f℥xlviij). Being of an attractive red color, and in such common use among physicians, it may be swallowed by mistake, and instances of poisoning in this way are not uncommon. In such cases, soap-suds and milk may be given at once, and the stomach carefully washed out with a soft tube, as vomiting may rupture the stomach. Arterial stimulants and external counter-irritation and hot applications may be required. Chrome yellow, or lead chromate, has been used by bakers in order to give a rich color to cakes. The symptoms are principally indicative of lead poisoning.

Therapy.—The solution of chromic acid is an excellent remedy for warts, syphilitic mucous patches, and enlarged tonsils (0.65 to 30 c.cm. of water, or gr. x ad aq. f℥j), applied with cotton or a camel's-hair brush once or twice a day. It has also been used in gynæcological practice in uterine hæmorrhage and endocervicitis, and has been injected into hæmorrhoids, and applied to hypertrophies of the nasal chambers, and also to some malignant growths. Sweating of the feet (hyperidrosis) is relieved by sponging the feet daily with a weak solution. Parasitic skin diseases, sycosis, lupus, tinea circinata, and condylomata require a stronger solution (6.50 to 30 c.cm., or gr.c

to f℥j). As the caustic action tends to spread, it should be used with caution, covering the neighboring surface with petrolatum, or some other protective ointment, and promptly removing excess of acid with an alkaline wash.

In favus, after the crusts have been removed, an ointment composed as follows has proved serviceable:—

℞ Potass. dichromat	1	Gm. or gr. xv.
Adipis	31	Gm. or ℥j.

M. ft. ungt.

A 1-per-cent. solution of chromic acid in water has been found by Professor Kaufman, of Alfort, to be an excellent remedy in cases of viper-bites. As an application to chronic ulcers the following combination is recommended:—

℞ Chromii trioxidi	2	Gm. or gr. xxx.
Acid. tannic.	1	30 Gm. or gr. xx.
Morphinæ sulph.		32 Gm. or gr. v.
Chlorali hydrati	23	32 Gm. or ℥vj.
Aquæ	473	c.cm. or Oj.

M. Sig.: Apply frequently with camel's-hair brush.

Chromic acid has been successfully used by Dr. W. R. H. Stewart in the treatment of ranula and cystic goitre. After the tumors had been opened, their contents washed out, and after hæmorrhage had ceased, a saturated solution of trioxide of chromium was applied to several points of the cyst-wall. Chromic acid is not used internally; but the potassium dichromate has been administered in doses of 0.006 to 0.012 Gm. (or gr. $^1/_{10}$-$^1/_5$); it acts as an emetic in doses of 0.048 Gm. (or gr. $^3/_4$). It has been used in chronic rheumatism and syphilis, made into pill with some vegetable bitter, but is of doubtful utility in these conditions.

Potassium Dichromate.—Dr. Joseph H. Hunt, of Brooklyn, praises the action of potassium dichromate as an expectorant in catarrhal conditions of the respiratory tract. To children of a year old, he is accustomed to give it in 0.0032 Gm. (or gr. $^1/_{20}$) doses. When the respiration is seriously embarrassed, he repeats the dose every fifteen or thirty minutes until the symptoms are ameliorated, when he diminishes the frequency to hourly intervals.

Following the suggestion of Vulpian, Professor Fraser, of Edinburgh, has, with advantage, made use of potassium dichromate in numerous cases of aggravated dyspepsia,[1] some of which were associated with distinctive symptoms of gastric ulcer. The remedy was generally given in the dose of 0.005 Gm. (or gr. $^1/_{12}$), sometimes increased to 0.01 Gm. (or gr. $^1/_6$), three times a day. Professor Fraser advises that the remedy be given during fasting, while the stomach is, as far as possible, empty. He states that potassium dichromate is capable of relieving, and often in a short time of removing, the entire group of symptoms, except constipation and anæmia, encountered in dyspepsia. It is particularly useful in alleviating pain, nausea, and vomiting. In gastric ulcer it did not succeed in checking hæmorrhage. In obstinate vomiting, gelatin capsules, each containing 0.006 Gm. (or gr. $^1/_{10}$), have been given every hour or two, with good results. In gastralgia also they have been successfully given, 1 three times a day, on an empty stomach, by Bradbury, of London.[2] Professor Fraser, of Edinburgh, read a paper

[1] *Lancet*, April 14, 1894. [2] *Lancet*, Sept. 14, 1895.

before the International Medical Congress at Rome on the use of this salt, recommending it in certain affections of the stomach.[1]

Potassium dichromate has likewise been administered with asserted benefit in locomotor ataxia. Dr. Diago reports very favorable results from the exclusive administration of this remedy in seven cases of hæmatochyluria, three of which depended upon the presence of filariæ. It was given in the dose of 0.02 to 0.03 Gm. (or gr. $^1/_3$-ss) in half a pint of water. He regards the salt as of value in the treatment of pernicious malarial anæmia. In cases of poisoning by potassium dichromate the same means are employed as in chromic-acid poisoning. At the present day it is rarely prescribed internally.

ACIDUM CITRICUM (U. S. P., B. P.).—**Citric Acid** ($H_3C_6H_5O_7 + H_2O$). **Dose,** 0.65 to 2 Gm. (or gr. x-ℨss). B. P., 0.32 to 1.30 Gm. (or gr. v-xx).

Preparation.

Syrupus Acidi Citrici (U. S. P.).—One per cent. Dose, 7.50 to 30 c.cm. (or fℨii-fℨj).

Pharmacology.—Citric acid is an organic acid, usually prepared from lemon-juice; it occurs in the form of colorless crystals soluble in less than their own weight of water. Citric acid is soluble likewise in alcohol and ether. It is not infrequently adulterated with tartaric acid, which may be separated in the form of bitartrate by the addition of a strong neutral solution of carbonate of potassium. It has a sour taste, not unpleasant in weak solutions. In substance it is irritating to the gastro-intestinal mucous membrane, and may thus act as a poison. It renders the urine acid. It is eliminated to some extent by the bowels, but principally by the kidneys.

Therapy.—In the proportion of 37 Gm. (or gr. dlxx) to 473 c.cm. (or Oj) of distilled water it forms a solution of the average acidity of lemon-juice, which may be further diluted and sweetened as a refrigerant drink for fever. It has been used also as a substitute for fresh lemon-juice in the treatment of scurvy, but is less efficient.

Citric acid has likewise been employed for the purpose of relieving inactivity of the liver and catarrhal jaundice. A 1-per-cent. aqueous solution of citric acid is said to be useful as an injection in gonorrhœa.

Citric acid has the power of sterilizing polluted water.

ACIDUM FORMICUM.—Formic Acid (CH_2O_2).

Pharmacology.—Many species of ants contain formic acid in its own form. The red ant, Formica Rufa, indeed, contains about half its weight of this peculiar constituent, the name of formic acid having been derived from this fact. These ants possess no stings; but they can inflict very irritating wounds upon the human body by biting through the skin with their strong mandibles and injecting formic acid into the flesh. The powerful irritation thus set up was at one time utilized in therapeutics by taking rheumatic patients near to an ants' nest, and making the insects angry so that they would bite the exposed surface around the affected joints. Recently, this has been revived in scientific medicine by substituting the hypodermic needle for the living insect for the introduction of the formic acid. Nearly three centuries ago (in 1670) two physicians, Wray and Fischer, obtained formic

[1] *Lancet*, April 14, 1894.

acid by distilling ants with water-vapor. They introduced the solution of formic acid into medical practice, principally for external use as a rubefacient, and, to a limited extent, for internal use, as a general stimulant and aphrodisiac. It has been only lately discovered that formic acid, being a methane derivative, can be produced in different ways, notably by the oxidation of methyl-alcohol, or by breaking up oxalic acid in the presence of glycerin. The latter, devised by Berthelot, is the method now generally adopted.

Formic acid readily combines with bases to form a series of salts, known as formates, which offer special advantages for the internal administration of this active agent. It has been demonstrated that the alkaline formates, notably the sodium and calcium formates, have a very stimulating effect upon the muscular elements, both striated and non-striated. Huchard, of Paris, in a communication to the Academy of Medicine (March 14, 1905), reported, as the results of extensive laboratory investigation, that "formic acid salts increase the work performed by the muscular tissues, three- or four-fold, without fatigue." He regards them as superior in their effects to caffeine, kola, strychnine, or spermine. Dr. Garrigues, also, as the result of his personal observations, reported to the Academy (March 28, 1904) that the administration of the formates induces not only an increase of the muscular strength, but also stimulates the appetite. This statement has been confirmed by Clement, of Lyons, and others. The conditions in which the formates of calcium and of sodium have been administered successfully, were certain forms of constipation, incontinence of urine, defective metabolism, and poor circulation, especially in phthisis, general asthenia, anorexia, and anæmia. The doses of the formates vary according to circumstances. In Huchard's physiological experiments upon himself and pupils, they took from 2 to 3 grammes per day (15 grains, two or three times a day), with very decided benefits, as shown by the ergograph, and, he claims, also without any deleterious after-effects. In phthisical patients, the urine excretion was increased from 20 to 52 grammes. Other observers have concluded that the more lasting results can be obtained by giving small doses, three times a day (0.06 to 0.30 Gm., or gr. j-v) for a prolonged period. The glycero-phosphates are synergistic with the formates, and they may be used in combination with strychnine or other cardiac tonic.

Pure formic acid (HCO, OH, molecular weight 45.67) has the peculiar property of acting both as an aldehyde and as an acid. It is crystallizable, but, at a temperature above 8.3° C., it is a colorless liquid, having a very pungent odor and burning taste. It is caustic and destructive to the skin when applied in full strength.

Therapy.—In modern therapeutics, formic acid is coming into use as a counter-irritant, in a 50-per-cent. solution; and in more dilute form, $2^1/_2$ to 3 per cent. For internal administration the German Pharmacopœia provides spiritus formicarum, or spirit of ants, which is composed of 2 parts formic acid, 35 parts alcohol, and 13 parts water. This solution may be given in doses of from 20 to 30 minims, as a general stimulant, acting very much like ammonia. The 50-per-cent. solution has been applied locally with success, as a counter-irritant, in treating neuralgia and rheumatism. It has also been used to prevent bed-sores. The $2^1/_2$-per-cent. solution is used in acute rheumatic arthritis. It has recently been used hypodermically, with remarkably beneficial results, by Dr. Louis B. Crouch (*Medical Record*, June 24, 1905).

ACIDUM GALLICUM (U. S. P., B. P.).—**Gallic Acid** ($HC_7H_5O_5 + H_2O$).

Dose, 0.13 to 0.65 Gm. (or gr. ii-x). B. P., 0.32 to 1 Gm. (or gr. v-xv).

An organic acid usually prepared from tannic acid (U. S. P.). A trihydroxybenzoic acid. It may be prepared by the action of diluted sulphuric acid on tannic acid (B. P.).

Pharmacology.—Galls are lumps or nodes upon the oak-tree, caused by insects. They contain about 50 per cent. of tannic acid, which, chemically, is an anhydride of gallic acid, and, in fact, is convertible into gallic acid by acids or simply by immersion in water. Its solutions strike a black color in the presence of iron, and they should not be prescribed in combination with chalybeates. Gallic acid is in the form of long needles, nearly colorless, slightly acid, though less astringent than tannin; it is soluble in 100 parts of cold water, 4 1/2 parts of alcohol, or 3 parts of boiled water.

Therapy.—Like tannin, gallic acid has the effect of restraining secretion, reducing swelling, and hardening tissues. It is eliminated by the kidneys under its own form. In solution, as the glycerite (1 part to 8 of glycerin) it forms a favorite application to sore throat or tonsillitis; and the ointment of gallic acid is a good application to hæmorrhoids, being an improvement upon the ointment made of powdered galls. The alcoholic solution is useful as a local application to the membranes in diphtheria.

Internally, gallic acid is given in hæmorrhage (1.30 Gm., or gr. xx, at a dose) from the alimentary canal, kidneys, or lungs; also in menorrhagia, but here it is inferior to ergot.

In hæmoptysis, ulcer of the stomach, hæmorrhage from the bowel, especially in typhoid fever, the following formulæ can be used:—

℞ Acid. gallic.	8	Gm. or 3ij.
Acid. sulphuric. arom.	4	c.cm. or f3j.
Morphinæ sulph.	.065	Gm. or gr. j.
Tinct. cardamom. co.	30	c.cm. or fʒj.
Aquæ rosæ	60	c.cm. or fʒij.

M. Sig.: One teaspoonful in water every hour or two.

℞ Acid. gallic.	8	Gm. or 3ij.
Glycerini	90	c.cm. or fʒiij.

M. Sig.: One teaspoonful every half-hour or hour until relieved.

This combination is a useful application to subacute pharyngitis or tonsillitis.

It has also been used to reduce the quantity of albumin in Bright's disease. On account of its astringent effects gallic acid is useful in a number of disorders attended by excessive secretion or transudation, as chronic bronchitis, cystitis, chronic diarrhœa, dysentery, and the night-sweats of phthisis. It is likewise serviceable in purpura hæmorrhagica. It retards the progress of pyelitis or pyelonephritis, and diminishes suppuration. Combined with opium, it has been found beneficial in diabetes insipidus.

ACIDUM HYDRIODICUM DILUTUM (U. S. P.).—**Diluted Hydriodic Acid.**

Contains not less than 10 per cent. of absolute acid and about 90 per cent. of water. Dose, 0.30 to 2.50 c.cm. (or *m*v-xl).

Preparation.

Syrupus Acidi Hydriodici (U. S. P.).—Syrup of Hydriodic Acid (contains about 1 per cent., by weight, of absolute acid). Dose, 2 to 15 c.cm. (or *m*xxx-fʒss).

Pharmacology.—Hydriodic acid is a gas which may be prepared by the action of iodine upon phosphorus in the presence of water, with the aid of gentle heat. It is colorless, but produces white fumes in air; it can be liquefied or even rendered solid by strong pressure and a low temperature. A solution of hydriodic acid in water, if exposed to the air, soon becomes discolored, and after a time deposits crystals of iodine. The solution is the official dilute hydriodid acid (U.S.P.). It should not be used if discolored. It is ten times the strength of the syrup.

Therapy.—The syrup of hydriodic acid is a valuable means of introducing iodine into the system. When administered in this way the iodine is liberated in the body, and is peculiarly active in its nascent form, and especially adapted for administration to scrofulous subjects and cases of catarrhal pneumonia of the chronic type. In some skin diseases of the same character the syrup of hydriodic acid, when properly made, has proved of great value. It is very efficacious in spasmodic asthma, especially of that variety which is linked with the gouty diathesis.

The syrup of hydriodic acid is an efficient remedy in tertiary syphilis, acute and chronic rheumatism, lumbago, rheumatoid arthritis, chronic lead poisoning, bronchitis, exophthalmic goitre, and other affections in which iodine is indicated.

Dr. James Craig, of Jersey City, speaks very highly of the syrup of hydriodic acid in acute rheumatism. He gives from 7.5 to 11 c.cm. (or f3ii-iij) in a wineglassful of water every two or three hours until relief is experienced, afterward reducing the dose and continuing the remedy for several days if required. The pain and fever are reduced within forty-eight hours, and he believes that this treatment exerts an important influence in preventing cardiac complications. Its power over serous exudation and fibrous adhesive inflammation is well illustrated in pleurisy with large effusion, or in plastic pleurisy with adhesions. As the latter is a prominent predisposing cause of phthisis, it is important that it should receive attention early and be overcome by the administration of iodine, especially in the form of syrup of hydriodic acid. Wile has used this preparation with success in various forms of lead poisoning.

ACIDUM HYDROBROMICUM DILUTUM (U. S. P., B. P.). — **Diluted Hydrobromic Acid** ($HB_2 + [H_2O]_9$).

Dose, 2 to 7.50 c.cm. (or *m*xxx-f3ij). B. P., 1 to 4 c.cm. (or *m*xv-f3j).

Pharmacology. — Hydrobromic acid resembles hydrochloric acid in being official only in solution, each being a gaseous substance. Diluted hydrobromic acid contains 10 per cent., by weight, of absolute hydrobromic acid (hydrogen bromide, B. P.). It is a clear, colorless solution with an acid taste, and can be given in lemon-syrup or simple elixir.

Therapy. — Hydrobromic acid should be an excellent antiseptic for dressing wounds, being sedative, non-poisonous, and bactericidal in its action. It was introduced as a substitute for the bromides, but it has not fulfilled the expectations of its projectors, although it has some anodyne and hypnotic effects. It is more pleasant to take than the bromides, is less apt to produce an eruption or physical depression, but it is more irritant to the stomach. In some cases of nervous cough, neuralgia, headache, and nervousness it has a good effect, but is ordinarily given in too small doses. Its action in epilepsy may be compared to that of the bromides, but the gastric irritability which it excites is a bar to its continued use. De

Schweinitz has found it useful in headache due to eyestrain. In cases of annoying tinnitus after taking quinine it is said to give prompt relief, although it often fails in relieving tinnitus from other causes. Two fluidrachms (7.50 c.cm.) are equivalent to 18 grains (1.16 Gm.) of potassium bromide.

To relieve irritative cough in phthisis:—

℞ Codeinæ	.065	Gm. or gr. j.
Acidi hydrobromici dil.	30	c.cm. or f℥j.
Syr. aurantii	60	c.cm. or f℥ij.

M. Dose, 1 or 2 teaspoonfuls.

ACIDUM HYDROCHLORICUM (U. S. P., B. P.).—**Hydrochloric Acid**, formerly **Muriatic Acid** (contains 31.9 per cent. by weight of absolute hydrochloric acid, with water, 68.1 per cent.; B. P., 31.79 per cent., by weight, of hydrogen chloride). ($HCl + [H_2O]$.)

Preparation.

Acidum Hydrochloricum Dilutum (U. S. P., B. P.).—Diluted Hydrochloric Acid (contains 10 per cent. of absolute hydrochloric acid in water; B. P. contains 10.58 parts of hydrogen chloride in 100 parts of water). Dose, 0.60 to 2 c.cm. (or *m*x-xxx).

Pharmacology.—The acid itself is an irritating, irrespirable gas. Its solutions are clear, colorless, and decidedly acid. When applied to the skin they are antiseptic and astringent; in some persons with delicate skin hydrochloric acid is irritating and slightly caustic. The salts of hydrochloric acid are officially termed hydrochlorides. Prominent among them are apomorphine, cocaine, hydrastinine, morphine, pilocarpine, and quinine hydrochloride.

Physiological Action and Toxicology.—When taken internally in poisonous doses, it acts as a violent irritant, causing burning pain, a strong acid taste in the mouth, red and swollen tongue, and discoloration of the lips. Vomiting occurs at once, and may be accompanied by bleeding. The patient is at first feverish, but soon falls into collapse, and dies of shock or exhaustion. Violent gastric inflammation is found after death, and the œsophagus and mouth show the effects of a corrosive poison. The vapor of ammonia escaping near the vomited matters produces a white cloud of ammonium chloride. The treatment is the same as for other corrosive mineral acids,—demulcent drinks, flour or soap and water, milk, oil, or eggs. The carbonates may be given cautiously, for fear of rupturing the stomach by the escaping carbonic-acid gas. The stomach being softened by the acid, it should be evacuated by the tube rather than by emetics, if vomiting does not occur spontaneously. There is, moreover, danger that, in the act of vomiting, a portion of the acid may find its way into the air-passages and thus still further extend the mischief. Subsequently, the patient must be treated for the resulting lesions, which are not limited to the intestinal tract, since congestion of the kidneys and lungs may also occur. Medicinal doses stimulate the appetite and promote digestion.

Therapy.—Topically, hydrochloric acid is applied to septic wounds, dissecting wounds, or bites of rabid animals. It has also been used, mixed with an equal proportion of honey, as an application to the throat in diphtheria. It is important that this application should be made only to the diseased

surface. It is a good addition to baths in cases of skin disease, as pityriasis versicolor or tinea, and in full strength it is used to destroy warts on the hands of children. The undiluted acid has been successfully used as a counter-irritant in sciatica. Dr. Gennatas, of Montpelier, applies three or four coats by means of a small brush, along the affected nerve, and wraps up the part in cotton. The application may be repeated in twenty-four or forty-eight hours.[1]

Dr. Morris, of New York, has, in some cases, utilized hydrochloric acid for the removal of carious and necrotic bone. Through a sinus or incision a 2- or 3-per-cent. solution of hydrochloric acid in distilled water is injected every two hours, or at bed-time, according to the circumstances of the case. The exposed portion of bone is rapidly decalcified, after which there is injected every second day an acid-pepsin solution made by adding 1 c.cm. (or *m*xv) of hydrochloric acid and 2 Gm. (or 3ss) of pepsin to 120 c.cm. (or f℥iv) of distilled water. The decalcified bone with caseous or fatty material is digested out within a few hours, leaving exposed clean dead bone, which can be attacked in the same manner.

When hydrochloric acid is given well diluted, it is acceptable to the stomach, being one of the constituents of the gastric juice. When fermentation of the food takes place, causing flatulence, or "windy dyspepsia," it may be due to a deficiency of this element. At all events, cases of weak digestion and dyspepsia are sometimes much benefited by 0.60 to 1.20 c.cm. (or *m*x-xx) of the diluted acid with half the quantity of tincture of nux vomica, after each meal. Where acid stomach is caused by the presence of bacteria, the antiseptic action is best obtained by administering the hydrochloric acid when the stomach is empty, shortly before eating. It is also held that the excessive secretion of hydrochloric acid (which forms one variety of acid stomach) may be prevented by administering an acid solution just before eating, on the rule that acids check acid secretions. Hydrochloric acid sometimes affords great relief in nausea. In intestinal indigestion with diarrhœa, this agent is also very effective, given one or two hours after meals. The temporary administration of pepsin in combination with the acid is of great value in cases of this kind, but the pepsin should not be continued too long, or the peptic glands may lose their functions.

A digestive mixture which is very beneficial is:—

℞ Acid. hydrochlor. dil.	15|	c.cm. or f℥iv.
Pepsin. pur.	15|	Gm. or ℥iv.
Glycerini	90|	c.cm. or f℥iij.

M. Sig.: One teaspoonful in water after meals.

In fevers, where the secretions are very much diminished and hydrochloric acid is not secreted, its administration is of great service in assisting digestion. In typhoid fever, dilute hydrochloric acid is very useful (0.60 to 1.20 c.cm., or *m*x-xx, every three hours), and it exercises an important influence upon the contents of the bowels, being slightly astringent and preventing the multiplication of bacilli. Relapse is less frequent under this treatment because autoinfection is less likely to occur. In other infectious zymotic diseases—as scarlet fever, small-pox, or diphtheria—hydrochloric acid, or compound chlorine solution, may be administered in the same way.

[1] *Lancet*, Nov. 20, 1897.

It is serviceably combined with the tincture of iron in the treatment of diphtheria, and the mixture may be used both internally and as a local application. The presence of a mineral acid has been shown to diminish the virulence of the toxins of diphtheria.

In phthisis it is serviceable in disinfecting to some extent the alimentary canal, checking excessive sweating, or watery discharges from the bowels, and promoting constructive metamorphosis.

A very beneficial combination for phthisis is:—

℞ Acid. hydrochlor. dil.,
Tinct. nucis vomicæ ..... aa 12 | 30 c.cm. or *m*cc.
Tinct. capsici ..... 4 | c.cm. or f℥j.
Tinct. cinchonæ ..... 150 | c.cm. or f℥v.
M. Sig.: Two teaspoonfuls in water after meals.

The liquor pepsini (N. F.), or liquid pepsin, contains saccharated pepsin, 40 parts; hydrochloric acid, 12 parts; glycerin, 400 parts; and water, to make 1000 parts. It is practically an artificial gastric juice, and can be used locally to cleanse wounds, or injected into the bladder to dissolve blood-clots. The usual dose for indigestion is a tablespoonful after eating.

Chlorine, for bleaching or disinfecting purposes, can be obtained by pouring hydrochloric acid upon manganese binoxide. It is a greenish-colored, intensely-irritating gas. (See **Chlorum.**)

ACIDUM HYDROCYANICUM DILUTUM (U. S. P., B. P.). — **Diluted Hydrocyanic Acid (Prussic Acid).** ($HCN + [H_2O]$.)

Dose, 0.06 to 0.30 c.cm. (or *mi*-v).

Pharmacology.—A liquid composed of 2 per cent., by weight, of absolute hydrocyanic acid (hydrogen cyanide, B. P.) and 98 per cent. of water. It is colorless, faintly acid, with taste and odor of peach-kernels, rapidly loses the volatile acid when exposed to the air and light, and deteriorates if kept too long; so that the dose is variable. We should always commence with the minimum dose and cautiously increase, because of the different degrees of activity of this preparation. Cherry-laurel water (Aqua laurocerasi) is official in the British Pharmacopœia, but not in U. S. P.; it is also of very variable strength, but is used in considerably larger doses (2 to 8 c.cm., or *m*xxx-℥ij). Diluted hydrocyanic acid is also present in the compound tincture of chloroform and morphine (B. P.). The cyanides of potassium and of silver are official (U. S. P.). By the addition of an acid to either of these salts, it will be decomposed and hydrocyanic acid set free, as in the following prescription:—

℞ Potassii cyanidi ..... | 065 Gm. or gr. j.
Acid. citric. ..... | 32 Gm. or gr. v.
Syr. Tolutani ..... 60 | vel 90 | c.cm. or f℥ii vel iij.
M. Sig.: A teaspoonful as a dose for an irritable cough.

Physiological Action and Toxicology.—Hydrocyanic acid is very poisonous as a gas, and given in the ordinary solution, in sufficient quantities to cause death, it is almost immediately fatal. In cases where it does not cause death at once, there is great prostration of bodily powers; weak, fluttering pulse; cold extremities, and impending collapse. Atropine, hypo-

dermically, is the physiological antidote. The chemical antidote is potass. carb. 1.30 Gm. (or gr. xx) in water, 120 c.cm. (or ℥iv), followed by:—

℞ Ferri sulphate	.65	Gm. or gr. x.
Tinct. ferri chlor.	3.88	Gm. or ℥j.
Aquæ	124.4	Gm. or ℥iv.

M.

According to Dr. Johann Antal, cobalt nitrate is an efficacious chemical antidote, but no time should be lost before emptying the stomach with the aid of stimulating emetics. Cold affusions to the spine, with frictions and faradism to the surface, and hot applications are also efficient. The peculiar bitter-almond odor of the ejecta indicates the character of the poison. Death generally occurs by suffocation, from paralysis of respiration. Elimination, as well as absorption, of hydrocyanic acid is very rapid. Ringer states that if life can be supported for half an hour recovery will usually occur. Professor Kobert advocates the use of hydrogen dioxide as an antidote to hydrocyanic acid. He uses a 3-per-cent. solution hypodermically and a 30-per-cent. solution for washing out the stomach. Vomiting is to be encouraged and artificial respiration practiced. Where poisoning has occurred by inhalation, it will not be necessary to wash out the stomach. Kobert's method of treatment has been used for several years in English mining and smelting works, where a great deal of cyanide is used. He recommends a cabinet containing both solutions in hermetically sealed flasks, with hypodermic syringe, also a stomach-tube and funnel, to be kept constantly ready for immediate use in chemical laboratories, photographic studios, gold-beating establishments, where the acid or cyanides are used.[1]

Locally, hydrocyanic acid at first slightly irritates the skin, but afterward acts as a sedative. It should not be used in skin diseases when the skin is broken, for fear of absorption. It has some action upon the brain, causing vertigo and hebetude; the respiratory centre is enfeebled and the motor nerves paralyzed, producing great muscular feebleness. The conducting power of the sensory nerves is diminished. It is a decided cardiac sedative, the pulse becoming slow, with lowered arterial tension. The poison also acts upon the respiratory function of the red blood-corpuscles, and prevents them from carrying sufficient oxygen to the tissues.

Therapy. — Hydrocyanic acid has been used as an antispasmodic in various forms of reflex vomiting, such as the vomiting of pregnancy and that of phthisis. It has also been employed in nervous cough, in irritable heart, and asthma. Whooping-cough, acute mania, and melancholia may also be relieved by the administration of hydrocyanic acid. As it is rapidly eliminated from the system, the dose should be repeated at short intervals. Its sedative effect upon the gastric mucous membrane renders it valuable in painful affections of that organ, such as gastralgia, ulcer, and cancer. The same benefit is obtained from its use in enteralgia. For external use it may be added to rose-water (7.50 to 240 c.cm., or f℥ii-f℥viij) with a little glycerin, to be applied in cases of troublesome pruritus.

ACIDUM HYPOPHOSPHOROSUM (U. S. P.).—**Hypophosphorous Acid.** (See **Acidum Phosphoricum.**)

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[1] *Merck's Archives*, March, 1900, p. 94.

ACIDUM HYPOPHOSPHOROSUM DILUTUM (U. S. P.).—**Dilute Hypophosphorous Acid.** (See **Acidum Phosphoricum.**)

ACIDUM LACTICUM (U. S. P., B. P.).—**Lactic Acid** ($HC_3H_5O_3$).

An organic acid, usually obtained by subjecting milk-sugar, or grape-sugar, to lactic fermentation; composed of 75 per cent., by weight, of absolute lactic acid (hydrogen lactate, B. P.) and 25 per cent. of water.

Preparations.

Syrupus Calcii Lactophosphatis (U. S. P.).—Syrup of Calcium Lactophosphate. Dose, 2 to 7.50 c.cm. (or f℥ss-ij).

Ferri Lactas.—Ferrous Lactate. Dose, 0.13 to 0.32 Gm. (or gr. ii-v).

Pharmacology.—A colorless, odorless, syrupy liquid, with an acid taste. On account of carelessness in manufacture it may contain hydrochloric, sulphuric, or sarcolactic acid and traces of metallic impurities. It is soluble in water and alcoholic solutions. The ordinary dose is from 1.20 to 2 c.cm. (or *m*xx-f℥ss), diluted and sweetened.

Physiological Action.—Lactic acid is present in the stomach during the digestion of carbohydrates, especially during the first stage of gastric digestion. When in excess, it forms one variety of sour stomach, and causes pain in different parts of the body, headache, etc. It has been asserted that rheumatism is due to an excess of this acid in the system, and the fact that rheumatic symptoms sometimes develop after partaking of sour milk or lactic acid seems to lend support to this view. Such patients are benefited by the use of alkaline treatment. Large amounts act as depressors to the nervous system and decrease the normal alkalinity of the blood, thus favoring myalgic and neuralgic attacks.

Therapy. — Locally, lactic acid, diluted with water and glycerin, has been used in tuberculosis of the throat and larynx and in diphtheria and croup as a solvent of false membrane. In lupus or tubercular ulceration of the tongue it has been found very useful, as well as in lupus of the face, diluted (15 to 30 per cent.).

A solution of lactic acid varying in strength from 10 to 30 per cent. is also a beneficial application to many laryngeal tumors. In a 20- to 40-per-cent. solution it has been employed with good result in suppurative otitis and ulcers of the nasal fossæ. Mosetig-Moorhof has used concentrated lactic acid locally in caries, lupus, and epithelioma.

In the external lesions of tuberculosis, Dr. Zippel, of Hamburg, prefers the application of gauze tampons soaked in lactic acid. In the treatment of tuberculous fistulæ the same writer recommends the introduction of rods composed of a paste made by gently heating 50 grammes (℥i℥v) each of gelatin, lactic acid, and water, and then adding 30 grammes (℥j) of menthol. The rods made of the congealed paste are covered with a layer of collodion.

In dyspepsia, with deficient secretion, pepsin may be combined with lactic acid and given after meals. Lactic acid is useful in lithæmia and phosphaturia. In the green diarrhœa of infancy, attributed by Hayem to a microbe, this agent well diluted (4 c.cm., or f℥j, in a tumblerful of recently-boiled water, sweetened with white sugar, of which solution a teaspoonful may be given every half-hour or hour, according to the case) is a very effi-

cient remedy, controlling irritability of the stomach, relieving pain, and changing the character of the discharges. It has been shown, however, that some of these cases are due to a specific microbe, while others depend upon hepatic disorder. In the latter class of cases the remedy is of no effect. Lactic acid is also of value in the vomiting of newborn babes caused by indigestion. It is likewise useful in the diarrhœa of typhoid fever, intestinal catarrh, and intestinal tuberculosis. Dr. N. V. Lojkin regards lactic acid as of great value in the treatment of chronic dysentery.

From theoretical consideration, the use of lactic acid in diabetes mellitus was proposed by Cantani. Cases have been reported in which, conjoined with appropriate dietetic regimen, it appeared to favorably influence the disease and lessen the quantity of sugar excreted. In other cases, again, it proved a failure.

Dr. Foucaut, of Orleans, suggests the use of lactic acid as a prophylactic in gout. He gives 4 c.cm. (or f℥j) a day for three weeks or a month, when the remedy is discontinued for ten or eleven days, after which it is resumed in the same manner. It is said to reduce the number of attacks and to render them less painful.

Lactic acid has been successfully used in arthritis deformans. Zolotorin,[1] in a case of ten years' standing, the last year of which the patient kept her bed, began with 0.60 c.cm. (or *m*x) on an empty stomach, no food being allowed for an hour and a half afterward, and gradually increased the dose to 2.50 c.cm. (or *m*xl) a day. In three weeks the woman could get out of bed and walk a little, the pains being much relieved and the joint circumference slightly diminished. The improvement continued until no care was required, and ordinary duties could be resumed. No internal medicine other than lactic acid was given, and no external treatment except slight massage.

The ammoniacal decomposition of the urine which takes place in chronic cystitis is checked by the administration of this remedy.

Ferrous lactate is in the form of greenish, crystalline scales or crusts, and is used as a chalybeate tonic, being less astringent and constipating than other iron salts. Zinc lactate has been used in the treatment of epilepsy in 0.13 Gm. (or gr. ij) doses, thrice daily, gradually increased to 0.65 Gm. (or gr. x).

ACIDUM NITRICUM (U. S. P., B. P.).—**Nitric Acid** (HNO_3).

Preparation.

Acidum Nitricum Dilutum (U. S. P., B. P.).—Diluted Nitric Acid (contains 10 per cent., by weight, of absolute nitric acid; B. P., 17.44 per cent.). Dose, 0.30 to 1.20 c.cm. (or *m*v-xx).

Pharmacology.—Nitric acid (U. S. P.) contains 68 per cent., by weight, of absolute nitric acid and 32 per cent. of water. B. P. contains 70 per cent., by weight, of hydrogen nitrate.

The ammonium, lead, and sodium nitrates and nitrohydrochloric acid are official in the U. S. P.; potassium and silver nitrates, spirit of nitrous ether, bismuth subnitrate, and diluted nitrohydrochloric acid in U. S. P.

[1] *La Médecine Moderne*, vol. ix.

and B. P. The solutions of ferric and of mercuric nitrate are official in the U. S. P., and solution of ferric nitrate and acid solution of mercuric nitrate in the B. P.

Physiological Action and Toxicology.—Diluted nitric acid when applied to the skin produces a yellowish discoloration. Stronger applications occasion a bullous eruption resembling pemphigus.

Introduced into the stomach in a concentrated solution, nitric acid is a violent corrosive poison, and produces vomiting, pain, and distress, at once, followed by inflammation and sloughing of the mucous membrane of mouth and œsophagus. Alkalies, demulcents, and milk diet constitute the treatment. Fatal accidents occasionally happen from inhaling the fumes of nitric, or other mineral, acids. In small doses nitric acid stimulates the intestinal glands.

When its use has been too-long continued, nitric acid causes salivation, spongy and bleeding gums, with loosening of the teeth, foulness of the breath, dyspepsia, colic, headache, and debility. These untoward effects soon disappear when the remedy is suspended.

Therapy.—Nitric acid is an oxidizing agent in the laboratory, and when applied in strong solution it has a decidedly caustic action, staining the skin yellow. It is the preferred caustic for venereal sores, warts, poisoned wounds, sloughing, and phagedæna. In uterine ulceration, prolapse of bowel, and hæmorrhoids, nitric acid is a useful application. Nitric acid has been successfully employed in the form of a lotion or foot-bath in the treatment of chilblains. Introduced into the system in small doses, well diluted, it acts as an astringent tonic, especially useful in cases of atonic dyspepsia, in uric-acid diathesis and oxaluria. Small doses of nitric acid are serviceable in stomatitis. In broken-down syphilitic subjects, or in chronic liver disease, nitric acid is a useful restorative.

A very valuable prescription, especially for the treatment of chronic syphilis, is as follows:—

℞ Acidi nitrici dil. ..... 12|30 c.cm. or *m*cc.
Fluidextracti lappæ ..... 90| c.cm. or f℥iij.
Fluidextracti xanthoxyli ..... 60| c.cm. or f℥ij.
M. Sig.: One or two teaspoonfuls in water three times a day.

In dilute solution (0.60 or 1.20 to 30 c.cm., or *m*x-xx to f℥j) it has been used, in cases of phosphatic calculi, to wash out the bladder, and it may be used for injection into sinuses connected with dead bone. A few drops of nitric acid to 30 c.cm. (or f℥j) of water is an excellent stimulant application to indolent ulcers. In whooping-cough, or bronchial catarrh, it has been advocated, and in hoarseness of public speakers a few drops in a glass of water afford relief. It is inadvisable to continue too long the administration of nitric acid, as, in that case, it excites gastro-intestinal catarrh. The same remark applies to the other mineral acids.

In many skin diseases, such as impetigo, lepra, acne, the addition of nitric acid to the bath has been found useful in addition to its internal administration.

Mistura Camphora Acida (N. F.).—Antidysenteric mixture, or Hope's camphor mixture:—

℞ Acidi nitrici[1] ..... 1 | 75 c.cm. or *m*xxvij.
Tincturæ opii ..... 1 | 20 c.cm. or *m*xix.
Aquæ camphoræ ..... 100 | c.cm. or f℥iiiss.

M. Dose, a tablespoonful every hour or two, according to symptoms. Used for diarrhœas of relaxation, especially in elderly persons.

Diluted nitric acid will often relieve chronic diarrhœa, and its efficacy may be increased by the addition of witch-hazel, thus:—

℞ Acidi nitrici dil. ..... 10 | c.cm. or *m*clx.
Fluidext. hamamelidis ..... 11 | c.cm. or f℥iij.
Syrup. aurantii ..... 120 | c.cm. or f℥iv.

M. Sig.: From one to two teaspoonfuls in water three or four times a day.

In the daily dose of 4 to 15 c.cm. (or f℥i-iv) dilute nitric acid has sometimes proved successful in diabetes insipidus, and it is said to allay the thirst of saccharine diabetes.

Full doses of well-diluted nitric acid, every fourth or sixth hour, are useful in intermittent fever. After the paroxysm has been broken up by quinine, nitric acid may be serviceably given, in order to relieve inactivity of the liver and intestinal glands. Small doses of nitric acid are beneficial in aphthæ and ulcerative stomatitis.

Nitric acid reddens morphine, and probably decomposes it; and, therefore, should not be prescribed in solutions with this agent, as the rule. The nitrites have a decided lowering influence upon the temperature and circulation; they will be considered in connection with amyl nitrite.

ACIDUM NITROHYDROCHLORICUM (U. S. P.).—**Nitrohydrochloric Acid, Nitromuriatic Acid** (nitric acid, 18 parts; hydrochloric acid, 82 parts).

Preparation.

Acidum Nitrohydrochloricum Dilutum (U. S. P., B. P.).—Diluted Nitrohydrochloric Acid (Diluted Nitromuriatic Acid) (contains 4 parts of nitric acid, 18 of hydrochloric acid, and 78 parts of distilled water). Dose, 0.30 to 1.20 c.cm. (or *m*v-xx).

The B. P. preparation is considerably stronger (Nitric Acid ℥iij; hydrochloric acid f℥iv; distilled water f℥xxv.)

Symptoms of poisoning and methods of treatment same as given under **Acidum Hydrochloricum.**

Pharmacology and Therapy.—The strong combination of nitric and hydrochloric acids is official only in the U. S. P. It should be allowed to stand for two weeks after mixing, and kept in a cool place. The concentrated solution readily dissolves gold leaf when immersed in it. For medical purposes, it should be greatly diluted. It is supposed to have a special action upon the hepatic functions, and is a good tonic and astringent. It has been applied upon compresses in chronic liver disorders, in a solution (15 c.cm., or f℥ss, to 473 c.cm., or Oj, of water).

Internally, the dilute acid is given in plenty of water, and generally through a glass tube, in torpidity of the liver, the chronic hepatitis of the tropics, and in the early stage of hepatic cirrhosis. It is of service in chronic diarrhœa and dysenteric diarrhœa. This acid has been occasionally known to produce salivation.

[1] The original formula for this preparation called for nitrous acid, but as commercial nitric acid usually contains some nitrous, it may be used as above.

ACIDUM OLEICUM (U. S. P., B. P.).—**Oleic Acid** ($HC_{18}H_{33}O_2$).

An organic acid, prepared in a sufficiently-pure condition, by cooling commercial oleic acid to about 5° C. (41° F.), then separating and preserving the liquid portion.

Preparations.

Oleatum Atropinæ (U. S. P.).—Oleate of Atropine (2 per cent.).

Oleatum Cocainæ (U. S. P.).—Oleate of Cocaine (5 per cent.).

Oleatum Quininæ.—Oleate of Quinine (25 per cent.).

Oleatum Veratrinæ (U. S. P.).—Oleate of Veratrine (2 per cent.).

Oleatum Hydrargyri (U. S. P., B. P.).—Oleate of Mercury (U. S. P. preparation contains 88.25 per cent. with oleic acid, representing 25 per cent. mercuric oxide).

Unguentum Hydrargyri Oleatis (B. P.).—Mercuric-Oleate Ointment (1 to 3 of benzoinated lard).

Unguentum Zinci Oleatis (B. P.).—Zinc-Oleate Ointment (50 per cent.).

Pharmacology.—Oleic acid is an oily, yellowish, tasteless liquid, gradually becoming brown, rancid, and acid when exposed to the air. It is insoluble in water, but soluble in alcohol, ether, etc.

Oleic acid, freshly prepared, is a bland and unirritating application to the skin, and was brought forward as an addition to ointments and liniments to increase their penetrating power, but lanolin has now largely taken its place for this purpose. Lately, greatly through the influence of the writings of the author, it has been much used in the manufacture of oleates, which are now produced in the form of true chemical compounds, instead of simple mixtures, as heretofore.

The following is a summary of the action of the oleates, from "Ointments and Oleates, especially in Diseases of the Skin"[1]:—

The Oleates.

Aconitine Oleate.—Not very active. Can be used in neuralgia.

Aluminum Oleate.—Diluted one-half with lard or some fatty substance, it forms the ointment of the oleate of aluminum, which is decidedly astringent. It is useful in checking the muco-purulent discharges of dermatitis and eczema, and in chafing, or intertrigo, especially in infants and young children. In hyperidrosis and in bromidrosis it is very effective. This ointment is also a useful dressing to burns, foul ulcers, chilblains, and sinuses.

Arsenum Oleate.—A valuable alterative and escharotic, but it must be used with caution. The oleate, when melted with lard or ointment base (1 to 4 or 1 to 9), forms the ointment of arsenum oleate. This has little action upon a healthy skin, but when the epidermis has been removed, or on granulating surfaces, it produces inflammation and destroys the vitality of the tissues to a considerable depth. When well diluted, it exerts a most excellent alterative impression upon the integument; and also in ulcerating epithelioma, in lupus (after scraping), and in old scrofulous ulcers, this is of great utility. In sycosis, seborrhœa, and chronic eczema it is likewise of service. After scraping or puncturing the affected area, it can be used to destroy warts, corns, horns, condylomata, old granulations, and nævi. It may be advantageously combined with opium, belladonna, hyoscyamus, arnica, arrow-root, naphthol, etc. (For formulæ, see author's book on "Oleates.")

Atropine Oleate.—Not very active. Constitutional effects not produced except where large surfaces are anointed.

Bismuth Oleate.—Emollient and slightly astringent. In all pustular eruptions, in sycosis, it relieves the itching and often aborts the pustules. It allays irritation in erysipelas and sunburn. In acne rosacea, it relieves the inflammation, and, in conjunction with scarification of the surface, is curative. In acute eczema, this oleate is considered indispensable in arresting the progress of the malady. Cracked and sore

[1] Second Edition. Philadelphia: The F. A. Davis Company, Publishers. Physicians' and Students' Ready-Reference Series. 1890.

nipples are usually healed by the oleate-of-bismuth ointment (1 part of bismuth oleate to 7 parts of ung. aquæ rosæ).

Cadmium Oleate is stimulating and irritating. It has been used in chronic eczema with great infiltration, exuberant granulations, and enlarged glands, the strength of the ointment being adapted to each case.

Cocaine Oleate (U. S. P.) contains 5 per cent. of the alkaloid. It can be combined with equal parts of ointment or lanolin. It has not answered expectations as a local anodyne or anæsthetic, but has been used with some benefit in pruritus pudendi and ani, or eczema marginatum.

Copper Oleate, in the form of 10- or 20-per-cent. ointment, has no visible effect upon the healthy skin, but penetrates deeply into the follicles, where it exerts a stimulating and antiseptic action. It is decidedly astringent to the broken skin or raw surface, reducing exuberant granulations, checking hæmorrhage from irritable sores and old ulcers. Owing to its parasiticide action, it is the best remedy for the various forms of ringworm. In tinea versicolor, even in favus, it is equally effective in destroying the parasite without epilation. Copper oleate, melted and spread as a plaster, will very often cure warts, corns, bunions, and thickened conditions of the epidermis. The ointment above referred to is also useful in freckles and other discolorations of the skin. It is essential that the salt should be made from pure oleic acid, as otherwise the application may be accompanied by irritation or inflammation of the skin. The weaker ointment (0.32 to 0.65 Gm., to 31.1 Gm., or gr. v-x to ʒj) should be first tried and the strength gradually increased.

Iron Oleate is a valuable styptic and astringent. The use of a weak ointment in the inflammatory form of eczema, in which the surface is raw and bleeding, is followed by good results; also in pustular eczema, sycosis, furuncles, and in scrofulous sores. Mixed with the oil of ergot or any bland oil, the iron oleate is of great advantage in dry seborrhœa and in patches of alopecia. The early stages of acne rosacea are often entirely relieved by the weak application of ointment of iron oleate. In ulcers caused by arsenical poisoning, this has given better results than any other remedy in the hands of the writer, especially with the addition of 1 per cent. of carbolic acid.

Lead Oleate, melted with equal parts of lard-oil, or lard, forms a cream-colored, semisolid ointment, which is superior to Goulard's cerate or Hebra's litharge ointment. It allays irritation in papular or pustular eczema, and also in fissured eczema of the hands or feet. In hard and indurated papules, as in acne of the face, neck, and back, it is excellent in its effects. Thymol, naphthol, carbolic acid, oil of chamomile, or oil of cade may be combined with it, according to the case.

Manganese Oleate has been used (a 10- to 20-per-cent. solution in ointment) as a remedy in amenorrhœa and other uterine affections, applied with friction to the abdomen. Probably its asserted good effects are to be attributed to the massage rather than to any constitutional effect from the manganese, as there is no evidence of its absorption.

Mercuric Oleate (U. S. P., B. P.).—The ointment of mercuric oleate is a yellowish substance of fatty consistence. It is stimulating to the skin, and has a decided alterant action upon the glandular structures. In old eczema, with thickening of the skin, this twofold action is very beneficial; also in papular and tubercular lesions, and infiltration attendant upon abscesses. In inflammation of the hair-follicles, sycosis, and scrofulodermata it is quickly curative. Its bactericidal action makes it valuable in all cases of parasitic invasion of the skin; and, in the treatment of lousiness, the addition of picrotoxin ($^1/_5$ of 1 per cent., or gr. i-ʒj) is advisable, in order to destroy the vitality of the nits. If it is desired to produce a constitutional impression, lanolin may be added, or mercurous oleate substituted. In fact, mercuric oleate is absorbed only very slowly. Large quantities have been applied to the surface without producing constitutional effects.

Mercurous Oleate.—This ointment contains a higher percentage of mercury than the preceding (41.6 per cent.); it is substituted when it is desired to make a more profound impression upon the structures of the skin, or to practice the inunction treatment of syphilitic affections, and for this is far superior to either the ordinary blue ointment or the mercuric oleate. In old spots of psoriasis and chronic plantar and palmar eczema it can be used alone, or combined with some form of tar or naphthol.

Morphine Oleate has only a feeble action upon the integument, and has no special advantage.

Nickel Oleate, in the form of ointment with some fatty base, has a very decided astringent action upon abraded surfaces. In the proportion of from 5 to 20 grains to the ounce of lard it acts well in epithelial ulcerations, old callous ulcers, or chronic eczemas.

Quinine Oleate (U. S. P.), 25 per cent. alkaloid, has some antiseptic action, but has no special advantages.

Silver Oleate coagulates albumin, and, when sprinkled over sores, coats the surface and excludes the air; at the same time it stimulates granulations and cleans off the surface. Dissolved in oleic acid and mixed with lard (5 to 60 grains to the ounce), it forms a dark-brown, pliable ointment, which may be applied in cases of erysipelas to keep the inflammation from spreading. In superficial lupus it sometimes lessens cell-infiltration and reduces active inflammation. In boils, carbuncles, eczema around the genitals or on the buttocks, especially if attended by irritation or itching, marked relief follows the application, either alone or combined with opium, belladonna, or hyoscyamus.

Strychnine Oleate has no special value as an ointment.

Tin Oleate.—The ointment (0.65 to 4 Gm., or gr. x to lx-℥j) is a grayish-brown ointment, possessing some astringent and tonic action. It is of especial service in diseases of the nails and in irritation of skin around the nails (agnail, etc.).

Veratrine Oleate (U. S. P.) is official in 2-per-cent. solution in ointment. It has decided counter-irritant and benumbing effects upon the skin, making it useful in some cases of neuralgia or tender spots.

Zinc Oleate (U. S. P., B. P.), is a fine, pearl-colored powder, soft and soap-like to the touch, is astringent in its effects, and can be used as a dusting-powder in hyperidrosis and bromidrosis. In local sweating of the axillæ, genitalia, hands, or feet, especially when attended by maceration of the epidermis, this agent is very useful. Murrell, of London, has also used it in the sweating of phthisis, combined with thymol (1 to 500). Salicylic acid (3 per cent.) or French chalk may be added to it, for the treatment of local affections, such as comedo and acute vesicular eczema. In all such acute inflammatory affections it can be used with advantage, where greasy applications cannot be borne. It has also been used in gynæcology as an application to cancerous ulceration of the cervix uteri. Here it may be combined with iodoform (zinc oleate, 1; iodoform, 2 parts).

ACIDUM OXALICUM.—Oxalic Acid ($H_2C_2O_4 2H_2O$).

Pharmacology and Therapy.—Oxalic acid is an irritant poison, and is sometimes taken by mistake for Epsom salts. Its antidote is lime, chalk, calcium carbonate, or whitewash.

Dr. F. J. L. Hart[1] reports two cases of poisoning by oxalic acid: One instance was a boy, aged 15 years, who had taken about 12 Gm. (or ℥iij) of the acid; he had several convulsive seizures, his pupils were dilated, lower jaw fixed in a tetanic spasm, froth exuding between the teeth, and pulse could not be felt—stomach-washing and the hypodermic injection of apomorphine, 0.006 Gm. (or gr. $^1/_{10}$), were resorted to as well as brandy, strychnine, and digitalis. The patient in a few days made a good recovery. In the second case the quantity taken was unknown, the patient dying within one hour.

Dr. Talbot Jones, of St. Paul, has reported four cases in which acute articular rheumatism was apparently produced by prolonged contact with a solution containing oxalic acid. The patients, engaged in making bluing, were accustomed to keep the hands and forearms immersed while stirring the solution.

According to Taylor, 4 Gm. (or ℥j) is the smallest quantity of oxalic acid which has been known to destroy life at the age of sixteen years, death occurring in eight hours. Under three minutes is given as the shortest-

[1] *Lancet*, Oct. 1, 1898.

known period of survival after an unknown quantity of this poison had been taken.

Oxalic acid has, at the suggestion of Dr. F. Poulet, been employed as an emmenagogue. Dr. A. W. Marsh has found it useful in amenorrhœa. He remarks that the remedy is not unpalatable, and, in medicinal doses, is unirritant to the stomach. Dr. Marsh also recommends oxalic acid in the treatment of acute cystitis from whatever cause. He is accustomed to prescribe:—

℞ Acidi oxalici	1	Gm. or gr. xvj.
Syr. aurant. cort.	30	c.cm. or f℥j.
Aquæ	90	c.cm. or f℥iij.

M. et ft. sol.
Sig.: Teaspoonful every four hours.

Poulet has found oxalic acid useful, likewise, as an expectorant in asthma, capillary bronchitis, and tuberculous bronchitis. He recommends the following formula:—

℞ Acidi oxalici	2	Gm. or ℥ss.
Infus. camelliæ	180	c.cm. or f℥vj.
Syr. aurant. cort.	60	c.cm. or f℥ij.

M. et ft. sol.
Sig.: A teaspoonful every hour.

In some cases where oxalic acid was given in 0.032 Gm. (or gr. ss) doses, Dr. F. W. Talley, of Philadelphia, observed that the remedy caused nausea, gastralgia, and an eruption resembling urticaria. When administered in solution the acid must be dissolved in either rain or distilled water, in order to avoid the deposition of oxalate of calcium of hard water.

ACIDUM PHOSPHORICUM (U. S. P.).—**Phosphoric Acid.**

ACIDUM PHOSPHORICUM CONCENTRATUM (B. P.).—**Concentrated Phosphoric Acid.**

ACIDUM HYPOPHOSPHOROSUM (U. S. P.).—**Hypophosphorous Acid** (30 per cent. absolute acid).

Preparations.

Acidum Phosphoricum Dilutum (U. S. P., B. P.).—Diluted Phosphoric Acid (10 per cent., by weight, of orthophosphoric acid; B. P. contains 13.8 parts of hydrogen orthophosphate). Dose, 0.12 to 1.20 c.cm. (or *m*ii-xx).

Acidum Hypophosphorosum Dilutum (U. S. P.).—Diluted Hypophosphorous Acid (contains 10 per cent. by weight of absolute acid, with 90 of water). Dose, 0.60 to 2 c.cm. (or *m*x-xxx).

Syrupus Hypophosphitum Compositum (U. S. P.).—Compound Syrup of Hypophosphites. Dose, 4 to 8 c.cm. (or 3i-ij).

Pharmacology.—Phosphoric acid in the solid form, glacial phosphoric acid, is not official. The official phosphoric acid is a colorless, odorless, syrupy liquid, containing not less than 85 per cent., by weight, of absolute orthophosphoric acid and not more than 15 per cent. of water. The British concentrated phosphoric acid contains only 66.3 per cent. of hydrogen orthophosphate. The diluted acid contains 10 per cent., by weight, of absolute orthophosphoric acid and 90 of water (13.8 parts of hydrogen orthophosphate in B. P.). The dose of phosphoric acid is 0.13 to 0.5 c.cm. (*m*ij-viij).

Physiological Action. — Phosphoric acid, locally, is an irritant, and exerts some escharotic effect. When taken internally, well diluted, it aids nutrition and growth, as it is an essential element in all bony and vascular structures in the form of phosphates. It is also, like nitric acid, a stimulant to oxidation. It improves the appetite and the digestion, increases secretion, and is synergistic with the vegetable bitters. Phosphoric acid has been known to give rise to an eruption resembling that of pemphigus.

Therapy.—In all debilitated conditions of the system, in anæmia, in the exhaustion of prolonged lactation, in bronchial catarrh of the aged, phosphoric acid is an excellent tonic; it is also useful in struma and wasting diseases. Its action being different from phosphorus in substance, it is less efficient in the treatment of neuralgic conditions.

Phosphoric acid is especially valuable as a tonic in the following formulæ:—

℞ Acidi phosphorici dil.	15	c.cm. or f℥ss.
Tinct. nucis vomicæ	12	30 c.cm. or *mcc.*
Tinct. ferri chloridi	60	c.cm. or f℥ij.
Syr. pruni Virg.	75	c.cm. or f℥iiss.

M. Sig.: From one-half to one teaspoonful in a wineglass of water, taken through a tube, after meals.

℞ Acidi phosphorici dil.	12	c.cm. or f3iij.
Strychninæ sulph.		03 Gm. or gr. ss.
Glycerini	34	c.cm. or f3ix.
Syr. aurantii	105	c.cm. or f℥iiiss.

M. Sig.: One teaspoonful in wineglass of water, taken through a tube after meals.

Under the name of liquor acidi phosphorici compositus (N. F.) an excellent tonic is furnished, composed of the following ingredients:—

Bone-ash	1000 parts.
Sulphuric acid (free from arsenic)	780 parts.
Water	4000 parts.

which is approximated by the following formula:—

LIQUOR PHOSPHATUM ACIDUS—ACID SOLUTION OF PHOSPHATES.

℞ Calcii phosphatis	25	Gm. or gr. 384.
Magnesiæ phosphatis	4	25 Gm. or gr. 64.
Potassii phosphatis	2	10 Gm. or gr. 32.
Ferri phosphatis	4	25 Gm. or gr. 64.
Acidi phosphorici (sp. gr., 1.710)	50	c.cm. or *m* 808.
Aquæ	q. s. ad 473	c.cm. or f℥xvj.

M. Sig.: This preparation may be given in teaspoonful doses, well diluted with water.

Given before meals, phosphoric acid is beneficial in hyperacidity of the stomach, whether due to increased production of hydrochloric acid or the result of fermentative changes in the food. Phosphoric may reasonably be preferred to the other mineral acids in the treatment of typhoid fever when the predominant symptoms denote great nervous prostration. In diabetes mellitus phosphoric-acid lemonade answers a useful purpose by assuaging thirst. It has been employed in rickets.

The diluted solution may be applied as a stimulant to indolent ulcers, and it has been proposed to inject it into enlarged glands.

The compound syrup of the hypophosphites is a popular and an agreeable tonic. (See formula given under **Calcium.**)

Dose, 4 to 8 c.cm. (or 3i-ij), given in water, three times a day.

ACIDUM PICRICUM.—Picric Acid.

Pharmacology.—Picric, or carbazotic, acid (trinitrophenol) is in the form of pale-yellow scales, soluble in water, and has a very bitter taste. Owing to its power of coagulating albumin, its watery solution forms a convenient test for albumin in the urine; it is also a test for peptones. Large doses cause vomiting, purging, and collapse. Internal dose from 0.03 to 0.13 Gm. (or gr. ss-ij); of the ammonium salt, 0.03 Gm. (or gr. ss.)

Therapy.—The application, five to ten times daily, of a 6-per-cent. solution of picric acid has been found useful in erysipelas. Picric acid constitutes also a good dressing to superficial burns, and has been used for several years for this purpose in the Charity Hospital of Paris. A saturated solution (about 0.5 per cent.) of picric acid is applied upon compresses. It exerts an analgesic effect upon the surface. It usually gives rise to no irritation, and the only disadvantage of the method is that the solution communicates a yellow stain to the tissues with which it comes in contact. Dr. Charles Willems, of Ghent,[1] speaks favorably of its use in burns of the first and second degrees; he uses it in the form of an ointment in the strength of 1 to 2 per cent.; he has never observed any toxic symptoms from its use, and the only inconvenience has been a yellow discoloration of the skin, which may be got rid of by alcohol washing or by a watery solution of carbonate of lithium. The late Dr. Quinquaud recommended picric acid as a local remedy in epithelioma. In chronic eczema Calvelli claims good results from the application, several times a day, of a solution of $1\,^1/_2$ parts of picric acid in 250 parts of distilled water.

The ammonium salt has been highly praised in the treatment of whooping-cough and malaria, the average dose being 0.032 Gm. (or gr. ss) four or five times daily. Dr. Marten Clark asserts that this salt has proved efficient in malarial neuralgia. Picric acid should be used, either internally or externally, with caution, since it is apt to excite urticaria and other symptoms of systemic intoxication.

Shoes lined with leather dyed yellow by picric acid have been known to excite violent dermatitis, the feet becoming swollen and being covered by innumerable vesicles, which coalesced and became filled with purulent serum. Constitutional reaction was also observed.

ACIDUM SALICYLICUM (U. S. P., B. P.).—**Salicylic Acid** ($HC_7H_5O_3$).

Dose, 0.32 to 1.20 Gm. (or gr. v-xx).

Preparations.

Ammonii Salicylas (U. S. P.).—Ammonium Salicylate. Dose, 0.12 to 0.60 Gm. (or gr. ii-x).

Bismuthi Subsalicylas (U. S. P.), Bismuth salicylate (B. P.).—Dose, 0.12 to 1.3 Gm. (or gr. ii-xx).

Quininæ Salicylas (U. S. P.).—Quinine Salicylate. Dose, 0.13 to 0.60 Gm. (or gr. ii-x).

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[1] *Annales de la Société Belge de Chirurgie*, May 15, 1898.

Strontii Salicylas (U. S. P.).—Strontium Salicylate. Dose, 0.30 to 2 Gm. (or gr. v-3ss).

Lithii Salicylas (U. S. P.).—Lithium Salicylate. Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Phenyl Salicylas (U. S. P.).—Phenyl Salicylate. (See Salol.)

Sodii Salicylas (U. S. P., B. P.).—Sodium Salicylate. Dose, 0.65 to 2 Gm. (or gr. x-xxx).

Unguentum Acidi Salicylici (B. P.).—Salicylic-Acid Ointment (2 per cent.).

Aspirin.—Acetyl-salicylic Acid. Dose, same as Salicylic Acid.

Pharmacology.—Salicylic acid is an organic acid existing naturally in combination in various plants, but most largely prepared synthetically from carbolic acid. It occurs as fine, white, needle-shaped crystals, soluble in 450 parts of cold or 14 parts of hot water; and in alcoholic solutions in 80 parts of chloroform, 60 parts of glycerin, and in 2 parts of olive-oil (by aid of heat). Thirty c.cm. (or f℥j) of sweet spirit of nitre will dissolve 1.04 Gm. (or gr. xvj) of salicylic acid. The solution remains clear even upon the addition of water. Crystallized salicylic acid is pure and without odor; precipitated acid has a rather peculiar, disagreeable taste; the sublimed acid is often pink colored, and smells of phenol. Dialyzed salicylic acid is preferred. It is claimed that the natural acid made from the oil of gaultheria is the best and purest form in which to prescribe it.

Physiological Action.—Salicylic acid is an antiseptic and antiferment, and prevents souring of beer, cider, or milk, or the putrefaction of urine. It arrests the action of saliva upon starchy food. It is injurious only when used constantly and in relatively large doses. It is very irritating to mucous surfaces, and is not to be administered in pill, powder, or capsule, but always in solution, and preferably with ammonium or potassium acetate, potassium citrate, or ammonium phosphate, which increases its solubility in water, or it may be given in some syrup or elixir of orange.

Taken internally, it reduces abnormally high temperature. In health this action is not observed, although some observers assert that a slight reduction is produced. Sometimes headache, giddiness, and ringing in the ears have been noticed, but usually no marked effect is seen upon either pulse or respiration. According to Vanden Corput, salicylic acid diminishes the functional activity of the testes, although it is asserted to cause congestion of the uterus and ovaries. It may produce abortion and, therefore, should be cautiously given in pregnancy, especially when a tendency to abortion or premature confinement exists. Toxic doses cause slowing of the breathing. Convulsions, nausea, burning in the throat, vomiting, and gastric irritability have also been observed to occur, followed occasionally by albuminuria, hæmaturia, or almost complete stoppage of urine. This is a deviation from the normal action, for in ordinary cases it acts as a diuretic, with slight increase of elimination of the urates and urea. Piccinini states that, after the administration of sodium salicylate, peptone is to be found in the urine. Salicylic acid is absorbed with rapidity, but slowly eliminated. In acute nephritis it diminishes the quantity of the urine and increases the proportion of albumin. It is stated that deleterious effects are particularly apt to occur in drunkards from the use of salicylic acid.

The treatment of intoxication by this agent is that for an irritant poison: the stomach should be washed out with warm water, decoction of coffee administered, and the patient treated symptomatically. The effects rapidly pass off as the acid is carried out from the system by the urine, principally

without change, partly also as salicin and salicyluric acid. Probably some also escapes in the sweat and saliva. After excessive doses the urine becomes olive-green in color, from the presence of indican and pyrocatechin. These substances result from the action of the pancreatic juice upon salicylic acid, or it may indicate the presence of phenol in the salicylic acid. A solution of chloride of iron strikes a violet color with urine which contains salicylic acid. In the body, the acid combines with glycocol in the liver and elsewhere, and becomes converted into salicyluric acid. The ingestion of salicylic acid, or sodium salicylate, may be followed by the development of various cutaneous lesions. Erythema with œdema, intolerable itching and tingling of the skin, and fever have been caused by large doses of the sodium salt. Other effects which have been observed are vesicles, pustules, and patches of ecchymosis.

Therapy.—For external use salicylic acid may be combined with chalk as a dentifrice. A similar mixture may be used for the relief of fetid perspiration (feet or axilla), or with talc or corn- or rice- flour. In gangrene, or sloughing cancer, it may be applied, but causes burning pain. Dressing may be saturated with an alcoholic solution and subsequently dried. It is not so powerful as carbolic acid, yet it has the great advantages of being odorless and freer from danger of toxic symptoms following absorption. It is also used in solution as a substitute for carbolic acid in the details of the modern antiseptic method. (A solution can be made by adding 8 parts of borax to 100 parts of boiling water, and, when dissolved, adding 10 parts of salicylic acid, and filtering when cool. On account of its irritant action it is not a good application for diphtheria or croup.) A saturated solution of salicylic acid, in collodion, is a very effective application to corns and warts. Tincture of cannabis Indica is often added, but it produces an unsightly stain without conferring any additional advantage. The solution of salicylic acid in collodion is likewise asserted to be an efficacious application in scabies, the skin having previously been cleansed by means of a hot alkaline bath. An ointment containing this substance is sometimes of benefit, especially in chronic eczema and in ulcerated lupus vulgaris. A similar application is efficacious in lupus erythematosus of the face and eyelids. A powder composed of 5 parts of salicylic acid, 15 parts of zinc oxide, and 30 parts of powdered starch may be employed to relieve the itching of urticaria and in eczema. From 0.32 to 4 Gm. to each 31 Gm. (or gr. v-lx to ℥j) of lard, lanolin, or other excipient will sometimes remove freckles. On account of its germicidal virtue, it may be advantageously used in the treatment of tinea circinata.

It has been found useful as a topical application in thrush and catarrhal stomatitis, in which conditions it acts as a local anodyne. It allays the burning pain of the erosions left after the vesicles have ruptured. The solution is made by dissolving 1 part of acid in sufficient alcohol and adding 250 parts of water. Salicylic-acid solutions have likewise proved of value in irrigation of the large intestine for dysentery. Acute intestinal catarrh has been treated in the same manner with very successful results. In the latter malady the internal use of the remedy may be conjoined.

Salicylic acid may also be employed in fetid bronchitis as an inhalation with a steam-atomizer, using 15.5 Gm. (or ℥ss) of borax in 503 c.cm. (or f℥xvij) of boiling water, to which 15.5 Gm. (or ℥ss) of salicylic acid is to be added. The same solution can be used in catarrhal pneumonia, in phthisis, etc.

The following formulæ will be serviceable as local applications:—

℞ Acidi salicylici ..... 8| Gm. or 3ij.
Bismuth. subnitrat. ..... 15|5 Gm. or ʒss.
Pulv. zinci oleatis ..... 8| Gm. or 3ij.

M. Sig.: Dust over the surface. Useful in excessive or fetid sweating and in seborrhœa oleosa.

℞ Acidi salicylici ..... 2| vel 4| Gm. or 3ss vel 3j.
Ungt. hydrarg. nit. ..... 12| Gm. or 3iij.
Betanaphthol ..... |65 Gm. or gr. x.
Ungt. zinci oxidi ..... 19|5 Gm. or 3v.

M. Sig.: Rub well into the surface several times a day. For fissured eczema of the palms of the hands and soles of the feet.

Lassar's paste is an excellent application for dry eczematous patches:—

℞ Acidi salicylici ..... |65 Gm. or gr. x.—M.
Zinci oxidi,
Amyli ..... aa 8| Gm. or 3ij.
Petrolati ..... 16| Gm. or ʒss.—M.
M ft. unguentum.

Internally, the use of salicylic acid in acute rheumatism (0.65 to 1.30 Gm., or gr. x-xx, doses every hour until 4 to 8 Gm., or 3i-ij, have been taken) for two days is generally followed by prompt relief. On account of its comparative insolubility, salicylic acid is now less used than sodium salicylate, which is given in the same doses. It is believed that the soda salt is rapidly converted into the original acid by the carbonic acid of the blood.

Salicylic acid approaches the character of a specific remedy in acute rheumatism. Its most marked effects are reduction of the articular swellings, the pain, and the fever. But it is not able to prevent the occurrence of heart trouble or of relapse. It is a good practice, and perhaps shortens the absolute duration of the case, to reduce or abandon the salicylic acid after it has produced its most notable results, and to replace or combine it with an alkali. It does not prevent hyperpyrexia, since that condition has been known to occur while this remedy was being administered. It will sometimes give rise to delirium when administered for a considerable period in the treatment of rheumatism. The virtue of the salicylic treatment is much less decided in chronic rheumatism, though stiffness and pain are relieved in a certain proportion of cases. In subjects who are much debilitated quinine salicylate may be employed, or, if anæmia be marked, the salicylate of iron. In muscular rheumatism salicylic acid will sometimes afford relief, and will often fail. The pain and swelling of rheumatoid arthritis are sometimes relieved and the progress of the disease arrested by sodium salicylate. The same salt is, in some instances, serviceable in gonorrhœal rheumatism. In acute articular gout and in irregular gouty manifestations good results have likewise attended the use of salicylic acid or the sodium salicylate.

It has been found that the local application of salicylic acid is beneficial in acute articular rheumatism. The drug acts by absorption, as it may be detected in the urine within half an hour after the application has been made. Dr. Bourget, who has long relied upon the external use of salicylic acid, regards the following as the best formula:—

℞ Acidi salicylici,
Adipis lanæ hydrosi ..... aa 10| Gm. or 3iiss.
Olei terebinthinæ rectificat. ..... 9|25 c.cm. or f3iiss.
Adipis ..... 77|5 Gm. or ʒiiss.
Ft. unguent.

It must be noted, however, that cases of intoxication have occurred as a result of the excessive local use of the remedy.

When the salicylate causes gastric disturbance, it may be given by the rectum, which should be previously washed out by means of a cathartic enema. It is well to combine laudanum with the salicylate in order to prevent irritation of the bowel. Labeeb has witnessed benefit from the local use of salicylic acid in sprains, irrespective of the presence of the rheumatic diathesis.

Salicylic acid, or its sodium salt, has been found useful in those affections so often associated with or dependent upon the rheumatic diathesis, as the various forms of neuralgia, especially migraine, trifacial neuralgia, and sciatica, chorea, tonsillitis, urticaria, and erythema nodosum. Sodium salicylate is serviceable also in erythema multiforme, especially when, as is frequently the case, the disease is dependent upon a rheumatic diathesis. The remedy suppresses the eruption and relieves the articular pains. In sciatica, Ringer prefers it to any other remedy. Rheumatic iritis may also yield to its influence.

Gay has successfully employed this remedy in Ménière's disease, giving 0.20 Gm. (or gr. iij) three times a day. The attacks of vertigo, which had been very frequent, rapidly diminished in number and severity. As improvement progressed, the remedy was suspended during considerable intervals.

In the experience of Dr. Strizower, salicylic acid is an excellent remedy in the treatment of gall-stones. He is accustomed to give it in 0.65 Gm. (or gr. x) doses three or four times a day in the intervals between attacks of colic, and states that it prevents the formation of concretions and hastens their expulsion.

Salicylic acid has been successfully used as an anthelmintic. Tænia solium has been removed by five hourly doses of 0.50 Gm. (or gr. viij) each, preceded and followed by a dose of castor-oil. Round-worms and seat-worms are destroyed by the same agent, the latter by the local effect of an injection, the former by the internal use of the drug.

Salicylic acid may be given in 0.32 Gm. (or gr. v) doses in order to purify the foul breath sometimes present in phthisis. Improvement has sometimes followed the administration of salicylic acid, or its combination with sodium, in diabetes. An antidiabetic powder employed by Dr. Monin is composed as follows:—

℞ Sodii bicarbonat.	62	Gm. or ʒij.
Sodii benzoat.	39	Gm. or ʒx.
Sodii salicylat.	19|5	Gm. or ʒv.
Lithii carbonat.	15|5	Gm. or ʒss.

M. Sig.: Teaspoonful at each meal.

The same remedy is of service in diabetic neuralgia. It is also employed for its antipyretic effect in typhoid fever, pneumonia, erysipelas, and phthisis, but it is regarded as especially serviceable in blood-poisoning and sapræmia, pyæmia, etc., and the eruptive fevers of children. Dr. de Rosa attributes prophylactic virtues to this substance in case of exposure to scarlet fever. Dr. C. A. Bryce esteems salicylic acid as of decided efficacy in the treatment of small-pox. He states that it reduces temperature, relieves pain, and limits the development of pustules. In relapsing fever it is said to render the relapse shorter and of less severity. It promptly checks the yeasty vomiting dependent upon the growth of *Sarcina ventriculi*. Some-

times serious disturbances of the circulation occur from medicinal doses in cases of fever. It is very probable that in some of these cases the results are attributable to impurities in the salicylic acid. Urticaria, erythema, and vesicular cutaneous symptoms have been noticed after its administration. Free desquamation has sometimes followed the erythema. In exceptional cases the exhibition of salicylic acid is followed by hæmorrhage, usually from the gums or nose. The soda salt is believed to be free from this objection.

Bernheim makes use of hypodermic injections of salicylic acid in order to relieve the night-sweats of phthisis. The solution which he employs contains 6 Gm. (or ʒiss) of the acid in 30 c.cm. (or fʒj) distilled water, to which is added 11 c.cm. (or fʒiij) of glycerin and 15 c.cm. (or fʒss) of alcohol. He injects 2 c.cm. (or *m*xxx) of the solution on four or five successive evenings. The same writer has reported five cases of inoperable cancer of the cervix uteri in which the injection of salicylic acid into the growth was followed by disappearance of the hæmorrhages and offensive discharge, with diminution in the size of the tumor. Sodium salicylate in 0.65 Gm. (or gr. x) doses will sometimes assuage the pain of carcinoma.

De Becker has treated a number of cases of acute pneumonia with salicylic acid. He gave to a child of four years 0.10 Gm. (or gr. iss) every hour with successful result. In adults he gives 0.50 Gm. (or gr. viij) every two or three hours. As soon as the expectoration is free, he diminishes the dose. Hot water, coffee, tea, chocolate, and milk are good vehicles for the medicine. He believes that if salicylic acid is given early (on first or second day) it will be found a true abortive of pneumonia. He treated twelve cases, with one death; the fatal result was due to meningitis. The others rapidly recovered.[1]

The granular effervescent form is a good one in which to administer the salicylates, or they may be given in effervescent draughts, or in combination like this:—

℞ Sodii salicylatis ..... 8| Gm. or ʒij.
Tinct. lavandulæ comp. ..... 15| c.cm. or fʒiv.
Syrup. aurantii ..... 105| c.cm. or fʒiiiss.
M. Sig.: Give a tablespoonful every three (or four) hours for acute rheumatism.

The following prescriptions may likewise be recommended as beneficial combinations in acute rheumatism, gout, and neuralgia:—

℞ Acidi salicylici ..... 8| Gm. or ʒij.
Spt. ætheris nitrosi ..... 120| c.cm. or fʒiv.
Tinct. cardamom. co. ..... 30| c.cm. or fʒj.
M. Sig.: Two teaspoonfuls in water every two hours.

℞ Acidi salicylici ..... 13| Gm. or gr. cc.
Liq. ammon. acetatis,
Aquæ camphoræ ..... aa 18|50 c.cm. or fʒv.
Spt. ætheris nitrosi ..... q. s. ad 60| c.cm. or fʒij.
M. Sig.: A teaspoonful in water every two or three hours.

The appended formula is serviceable in chronic rheumatism and gout:—

℞ Acidi salicylici ..... 12| Gm. or ʒiij.
Fluidextract. rhamni purshianæ ..... 8| c.cm. or fʒij.
Elixir aromat. (N. F.) ..... 120| c.cm or fʒiv.
M. Sig.: A tablespoonful in water two or three times a day.

[1] *British Medical Journal*, Epitome, 1952, 1898, p. 87.

On account of its influence upon the utero-ovarian circulation, the drug may be advantageously given in cases of amenorrhœa and dysmenorrhœa. Sodium salicylate has been used with excellent effect in chronic pleurisy. It promotes absorption of the effusion by a powerful diaphoretic action, comparable to that which it exerts in rheumatism.

Since the use of salicylic acid has sometimes been followed by anæmia, Professor Peabody, of New York, combined it with iron, as follows:—

℞ Acid. salicylic.	1	30 Gm.	or gr. xx.
Ferri pyrophosph.		32 Gm.	or gr. v.
Sodii phosphat.	3	25 Gm.	or gr. l.
Aquæ	15	c.cm.	or f℥ss.

M. Sig.: To be taken at a dose.

ACIDUM STEARICUM (U. S. P.).—**Stearic Acid** ($HC_{18}H_{35}O_2$).

Stearic acid is an organic acid which, in its commercial, more or less impure, form, is usually obtained from the more solid fats, chiefly tallow. It is a hard, white, somewhat glossy, solid; odorless and tasteless, and permanent in the air. Insoluble in water, it dissolves in about 45 parts of alcohol at 15° C. (59° F.); it is readily soluble in boiling alcohol and in ether.

Stearic acid has no physiological action upon man and is employed in medicine only in the manufacture of glycerin suppositories. The fixed or fatty oils, of either animal or vegetable origin, consist mainly of a mixture of three fatty principles,—olein, palmitin, and stearin,—which are glycerides of the corresponding acids. Immanuel Munk has shown that fatty acids alone are competent to produce the nutritive effects of fat, the glycerin being unnecessary and sometimes injurious. Senator has advocated, for cases that cannot tolerate codliver-oil, the administration of the fatty acids, which can be given in keratinized pills so as to pass through the stomach unchanged. He regards the saponified fat acids, or soda-soaps, as preferable either to fats or pure fat-acids. Being already in a soluble and absorbable condition, they make no demands upon the digestive capacity of the intestines.

ACIDUM SULPHORICINICUM.—Sulphoricinic Acid.

Pharmacology.—This derivative of castor-oil is only slightly irritant to the skin, though rapidly fatal to animals when injected into the veins, pleura, or peritoneum. The sulphoricinate of sodium is made by exactly neutralizing sulphoricinic acid with soda.

Physiological Action.—The salt is antiseptic and deodorizing and adheres well to the skin. Berlioz found that a 10-per-cent. solution entirely destroyed the odor of five or six times its weight of very fetid pus.

Therapy.—The sodium salt has been used as a topical remedy in ozæna, diphtheria, and laryngeal tuberculosis. Several antiseptic compounds have been prepared with the sulphoricinate of sodium. Sulphoricinated naphthol forms an emulsion which has been used in ozæna. Sulphoricinated creosote is used pure, or made into an emulsion with water, in laryngeal tuberculosis. Sulphoricinated salol has been employed either in its own form or diluted, as an application to ulcers. Sulphoricinated phenol is made by dissolving, with a little heat, 40 Gm. (or ℥i ¼) of pure carbolic acid with 100 c.cm. (or f℥iiif℥ij) of sulphoricinate of sodium. A

solution of one-fourth of this strength is used in some of the hospitals of Paris in diphtheria. The mixture adheres well to the surface and does not irritate or cause pain. It is applied upon pledgets of cotton, and is not washed off by gargles or irrigations. A combination of 10 parts of salol, 2 parts of creosote or terpin hydrate, and 80 parts of sulphoricinate of sodium is also serviceable as a topical application in diphtheria.

ACIDUM SULPHURICUM (U. S. P., B. P.).—**Sulphuric Acid** (H_2SO_4).

Preparations.

Acidum Sulphuricum Dilutum (U. S. P., B. P.).—Diluted Sulphuric Acid (U. S. P.) contains 10 per cent., by weight, of absolute sulphuric acid; B. P., 13.65 per cent. of hydrogen sulphate). Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Acidum Sulphuricum Aromaticum (U. S. P., B. P.).—Aromatic Sulphuric Acid, Elixir of Vitriol (U. S. P. contains sulphuric acid, 100 c.cm.; with tincture of ginger, 50 c.cm.; oil of cinnamon, 1 c.cm.; and alcohol, q. s. to make 1000 c.cm.). Dose, 0.60 to 1.20 c.cm. (or *m*x-xx).

Pharmacology.—The official U. S. P. acid contains not less than 92.5 per cent., by weight, of absolute sulphuric acid and not more than 7.5 per cent. of water. The B. P. acid contains 98 per cent., by weight, of hydrogen sulphate. It must be colorless, without odor, and of an oily consistence. It is very caustic and corrosive, and should be kept in glass-stoppered bottles. The commercial acid (oil of vitriol) contains various impurities,—arsenic, lead, nitric acid, etc.

Physiological Action and Toxicology.—Sulphuric acid, in full strength, chars animal substances and has a strong affinity for water. Applied to the skin, it acts as a caustic, redissolving the coagulum formed and penetrating deeply, turning the surface black. When taken internally, the lips and other parts of the mouth are blackened, and symptoms of corrosive poisoning are produced; there is intense pain, with efforts at vomiting. Collapse and death may rapidly ensue from the intense congestion of the œsophagus and stomach, or it may occur secondarily from the resulting gastric ulceration and strictures of the œsophagus.

Renal lesions have been found by Drs. Eugene Fränkel and F. Reiche in three cases of poisoning from sulphuric acid, one of which caused death in five hours, while the other two cases were fatal in from two to four months. The appearance of the organs was much the same in the three cases. In each, coagulation-necrosis was present and was more extensive in the first than in the succeeding cases, in which the lesion was limited to small patches.

The stomach-pump, if employed, should be used with extreme care on account of the danger of tearing the softened mucous membrane or of rupturing the stomach. Alkalies should be given, with milk or soap-water, and morphine hypodermically to relieve pain, combined with atropine as a cardiac stimulant. Oil, white of eggs, and magnesia are also appropriate. Demulcents and appropriate treatment for the succeeding inflammation will be needed. Sulphuric acid is sometimes maliciously thrown upon a person, especially in the face. In such a case soapy water is to be used to wash off the excess of acid, and an alkaline wash applied; to relieve pain, opium internally will be needed. The subsequent treatment is that of an ordinary burn.

Sulphuric acid is eliminated to a small extent by the kidneys and probably also by the lower bowel and skin.

Therapy.—On account of the pain following its application, sulphuric acid is not much used as a caustic, although it is an efficient destroyer of tissue. Velpeau used it in cancer, and Ricord for chancres, the acid being mixed with some absorbing substance like sawdust or charcoal. In caries and necrosis, and suppurating cavities or sinuses, it may either be applied upon a glass rod or on lint, diluted with 4 to 6 parts of water.

Internally, dilute sulphuric acid acts as an astringent and antiseptic. The elixir of vitriol is the preferred form for checking the night-sweats of phthisis, and in some cases of diarrhœa. Sulphuric acid, with water, sweetened so as to make a pleasant drink, is a valuable prophylactic against lead poisoning, often used by operatives in lead works. It also has been found to be a preventive of attacks of Asiatic cholera, when taken regularly during the prevalence of an epidemic.

℞ Acid. sulphurici diluti	9 | 25	c.cm. or f℥iiss.
Tr. opii deodorati	4	c.cm. or f℥j.
Elixir aromatici	30 |	c.cm. or f℥j.
Aquæ q. s. ad	120 |	c.cm. or f℥iv.

M. Sig.: Take a tablespoonful for catarrhal dysentery every hour or two. Watch with care the action of the opium.

Sulphuric acid has been given as an astringent in typhoid fever. It may be preferred to hydrochloric acid when the diarrhœa is excessive. Lead colic is relieved by the use of sulphuric acid, and the constipation of lead poisoning is effectually treated by a combination of diluted sulphuric acid, quinine sulphate, and magnesia sulphate. On account of its astringent properties it is beneficial in hæmorrhage from the uterus, stomach, or intestinal canal, and in purpura. The following prescriptions have been found beneficial:—

℞ Acid. sulph. aromat.	7 | 50	c.cm. or f℥ij.
Fluidextracti hamamelidis,		
Fluidextracti ergotæ aa	60 |	c.cm. or f℥ij.

M. Sig.: Two teaspoonfuls in water every two or three hours. Use especially in hæmorrhage from lungs, stomach, or womb.

℞ Acid. sulph. aromat.	15 |	c.cm. or f℥ss.
Magnesii sulph.	62 |	Gm. or ℥ij.
Spt. chloroformi	11 |	c.cm. or f℥iij.
Inf. rosæ gallicæ q. s. ad	240 |	c.cm. or f℥viij.

M. Sig.: A tablespoonful every three hours. Useful in hæmorrhage from rectum, and constipation.

℞ Acid. sulph. dil.	15 |	c.cm. or f℥ss.
Quininæ sulph.	| 75	Gm. or gr. xij.
Tinct. opii	7 | 50	c.cm. or f℥ij.
Syrupi et aquæ q. s. ad	90 |	c.cm. or f℥iij.

M. Sig.: A teaspoonful in water every four hours in enteric fever with tendency to diarrhœa and sweating. Also useful in sweating of phthisis.

Liquor Acidi Sulphurici Halleri (Haller's acid drops)—not official—is a mixture of equal parts, by weight, of acid and alcohol, gradually added with constant stirring, taking care that the temperature of the mixture does not get so high as to vaporize the alcohol. It contains ether, alcohol, sulphuric acid, and sulpho-ethylic acid, and is used for the same purpose as

the aromatic acid, in about half the dose, on account of the larger amount of acid.

Acidum Sulphovinicum, or ethyl-sulphuric acid, is prepared by adding sulphuric acid to alcohol in combining proportion. It is freely soluble in alcohol, and mixes with water (1 or 2 parts) without losing its oily character. It is a yellowish liquid, with slightly astringent taste, and is neutral in reaction. The ethyl sulphates are crystallizable and soluble in water. The ethyl-sulphate (or sulphovinate) of sodium has been used as a saline cathartic. Ethyl-sulphuric acid is an example of an acid ether, and is a solvent for camphor (25 per cent.), iodoform (3 per cent.), sulphur, naphtalin, chrysarobin, etc., and can be used as a vehicle for these remedies in the treatment of skin diseases.

ACIDUM SULPHUROSUM (U. S. P., B. P.).—**Sulphurous Acid** (H_2SO_3).

Dose, 0.30 to 4 c.cm. (or *m*v-f℥j), well diluted.

Preparations.—In combination with a base, sulphurous acid makes sulphites. Of its combinations, the following are official in the U. S. P.: sodium sulphite, sodium bisulphite, and sodium thiosulphite.

Pharmacology.—Sulphurous-acid gas (sulphur dioxide, SO_2) is produced by burning sulphur in the open air; when combined with water, it forms the official acid. It has a sour, sulphurous, somewhat astringent taste, and contains 6.4 per cent., by weight, of the gas, and not more than 93.6 per cent. of water. The B. P. acid contains the equivalent of 5 per cent., by weight, of sulphurous anhydride, or dry sulphur dioxide.

Physiological Action.—This acid and its salts are very destructive to low forms of animal and vegetable life, owing to their affinity for oxygen. It is not well borne by the stomach, and should be given freely diluted with water, as its taste and odor are very unpleasant. Locally, it does not excite much irritation in medicinal doses, but inhalation of air containing from 1 to 3 parts of sulphurous acid per 1000 produces in animals intense inflammation of the respiratory passages and lungs. Injection of a 5-per-cent. solution into the stomach was found by Dr. L. Pfeiffer to excite severe gastritis. Animals not killed by the acid recover very rapidly from the immediate effects, though they may subsequently perish from inflammation. Pfeiffer has demonstrated that 96.5 per cent. of sodium sulphite is eliminated in the urine as sulphate, the remainder only as sulphite. Nearly all of a large quantity of sulphite administered was eliminated in five hours.

Therapy.—As a local antiseptic or bactericide, sulphurous acid is highly prized in those forms of skin disease caused by parasitic invasion, such as tinea tonsurans and tinea versicolor. It may be effectively used in tinea favosa by the simple device of Dr. Schuster. A net of strings is stretched across the lower third of a card-board box made to fit the head. A saucer containing burning sulphur is laid upon the net of strings and the box covered. The patient must sit still for half an hour. An abundance of sulphurous-acid gas is generated, the sulphur ceasing to burn, of course, as soon as all the oxygen is exhausted. In various forms of sore throat it is useful, but particularly in diphtheria, where it can be used topically and also taken internally.

It is beneficially applied to unhealthy or sloughing wounds or ulcers. Four to 7.5 c.cm. (or f℥i-ij) of the official acid to 30 c.cm. (or f℥j) of water,

or water and glycerin, is of service in chilblains and chapped hands. Sulphurous acid, as Ringer points out, may be used in such a manner as to cure scabies with the utmost rapidity. This method consists in exposing the patient, his head excepted, to the influence of sulphurous-acid gas, generated by burning 46.7 Gm. (or ʒxij) of sulphur in a suitable closed apparatus. The clothes should be, at the same time, put in boiling water. Dr. Dewar recommends equal parts of sulphurous acid and of water as an efficient dressing in erysipelas.

In fermentation of food in the stomach, flatulent dyspepsia with sour stomach, pyrosis, dilated stomach, etc., sulphurous acid, properly diluted, has been recommended. In typhoid fever it has also been used, and, it is asserted, with success, and may be tried in measles, scarlatina, and small-pox. In some bronchial affections—catarrh, whooping-cough, dilated bronchial tubes—it may be inhaled with a steam-atomizer. It is also of great service in many skin affections, such as urticaria and purpura, after other methods have failed.

The author would recommend the following formulæ for the diseases just referred to:—

℞ Acidi sulphurosi,
Syrup. zingiberis ..... aa 60| c.cm. or fʒij.
M. Sig.: From one to two teaspoonfuls in water three times a day.

℞ Acidi sulphurosi,
Fluidext. ergotæ,
Syrup. aurantii ..... aa 30| c.cm. or fʒj.
M. Sig.: Two teaspoonfuls in water three or four times a day.

The sulphites and hyposulphites are employed to fulfill the same indications. The administration of the sulphites in pyæmia was advocated by Polli, but later clinical observers have not been able to obtain the good results that he reported. (The sulphides will be considered under the head of **Sulphur.**)

ACIDUM TANNICUM (U. S. P., B. P.).—**Tannic Acid (Tannin).**

Dose, 0.065 to 1.30 Gm. (or gr. i-xx). B. P., 0.13 to 0.32 Gm. (or gr. ii-v).

Preparations.

Collodium Stypticum (U. S. P.).—Styptic Collodion (consists of 20 parts of tannic acid, 5 of alcohol, 25 of ether, and 50 of collodion). For external use as an astringent.

Unguentum Acidi Tannici (U. S. P.).—Ointment of Tannic Acid (contains 20 per cent. of tannic acid).

Glyceritum Acidi Tannici (U. S. P.).—Glycerin and Tannic Acid (20 per cent.).

Trochisci Acidi Tannici (U. S. P., B. P.).—Troches of Tannic Acid (each 0.065 Gm., or gr. j; B. P., 0.03 Gm., or gr. ss).

Glycerinum Acidi Tannici (B. P.).—Glycerin of Tannic Acid (20 per cent.).

Suppositoria Acidi Tannici (B. P.).—Tannic-Acid Suppositories (0.20 Gm., or gr. iij, of tannic acid).

Tannalbin.—Tannic Acid and Albumin. Dose, 2 to 8 Gm. (or ʒss-ij). See Tannalbin.

Pharmacology.—Tannic acid is a common constituent of vegetable organisms, especially those noted for astringency, such as oak-bark. Galls contain about 50 per cent. of tannic acid, which can be obtained by exposing powdered galls to dampness and afterward dissolving out the tannic acid with

the aid of ether. It occurs in light-yellowish scales, soluble in 16 parts of cold water, and slightly soluble in alcohol. It is likewise soluble in glycerin. It coagulates albumin and gelatin, and strikes a black color with preparations containing iron. Solutions containing tannic acid (decoctions of black tea or coffee) are antidotes for poisoning by some metallic salts, and especially antimony or tartar emetic, and the alkaloids.

Physiological Action. — Tannic acid, when locally applied, has an astringent action upon the tissues, owing to its affinity for albumin. Internally, it acts as a weak acid upon the digestive tract, but when its chemical affinities are satisfied by combination with a base or neutralizing it with albumin, it is no longer capable of precipitating albumin, and therefore no longer exercises an astringent action upon the parts with which it comes in contact. Hence, according to Stockman, it can exert little, if any, action upon the vascular system, and, as it is not excreted by the bronchial mucous membrane, very little, or none, upon the flow of the bronchial secretions. With regard to its action upon the kidneys, as it is excreted principally by this channel, it is conceivable that it may have some influence in diminishing albuminuria, although even this he regards as doubtful. Lewin, however, recommends the administration of tannic acid in the form of an albuminate, which is free from irritation and is more readily absorbed (tannic acid, 2 parts; water, 90; mix well, and add white of egg, 10 parts). The external or internal use of tannic acid may occasion erythema or urticaria.

Therapy.—As a local astringent, tannic acid heads the list. A combination of iodoform and tannic acid (2 to 1), finely powdered, is a good dusting-powder for moist eruptions, some forms of eczema, and for insufflation into the nose to reduce secretion in catarrh. After the severity of the inflammation has somewhat subsided, the glycerite of tannin is a good application in acute eczema. It may be applied twice daily, and allays the stinging pain and itching. A solution of tannic acid and camphor has been used with good results as a topical application in erysipelas and lymphangitis. The glycerite of tannic acid is a good topical application to tonsillitis or pharyngitis. It may also be used as a spray, properly diluted, in hæmoptysis. A stronger solution (50 per cent.) has been recommended by Capullano [1] as a dressing for burns of all degrees. For disorders of the lower bowel, ulcers, fissures, hæmorrhoids, prolapsus, and to expel thread-worms, a solution may be injected, or suppositories used, each containing 3 to 5 grains, with cacao-butter or starch.

Liebersohn has obtained good results in severe acute dysentery from the use of hot enemata of tannic and boric acids. The injections were given every three hours and consisted of a 4-per-cent. solution of boric acid, in which 0.65 Gm. (or gr. x) of tannin were dissolved. A few drops of laudanum were added to each enema. The effect was to arrest hæmorrhage, diminish pain and tenesmus, and materially abridge the course of the disease. A plan of treatment introduced by Cantani has been used with advantage in the early stage of cholera. Large enemata of tannic acid are thrown into the bowel beyond the ileo-cæcal valve. From 6 to 19.5 Gm. (or ʒiss-v) of tannic acid, dissolved in 2 litres (or Oiv) of water, with the addition of 2 c.cm. (or *m*xxx) of laudanum and 46.5 Gm. (or ʒiss) of powdered gum arabic, are injected at suitable intervals.

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[1] *Gaz. delgi Osped.*, September 13, 1903.

A solution of tannic acid is useful in cases of leucorrhœa. The glycerite, or iodoform-tannin, is an excellent application for catarrhal inflammation of the cervix uteri. Even in carcinoma uteri the glycerite of tannic acid is efficient in moderating discharge and allaying odor. Its virtue may be assisted by combining it with a small proportion of liquefied phenol.

The odor of ozæna and other affections attended by fetor may, according to Dr. B. W. Richardson, be overcome by the application of cotton-wool, previously moistened in a saturated watery solution of tannin and dried.

In gonorrhœa, after the acute stage has passed off, tannic acid is a useful medicament. In men it may be administered, dissolved in water, as a urethral injection. Dr. Hanika, of Munich, has treated gonorrhœa by filling the urethra with a powder consisting of equal parts of tannin, iodoform, and thallin sulphate. The powder is introduced through a metal tube once or twice daily immediately after the patient has emptied his bladder. In women a watery solution may be used as a vaginal injection, or the vagina may be packed with gauze covered with tannin. Solutions of tannic acid may also be employed for the purpose of hardening tender nipples and tender feet. A concentrated solution of tannin may answer a useful purpose as a palliative remedy in ingrown nail. A lotion of tannic acid is frequently of service in herpes. It is useful in phagedenic ulcers and alopecia circumscripta. Made into a pomade, it has been found of benefit in dandruff. Ringer recommends the glycerite of tannic acid in otorrhœa, not, however, during the acute stage, but after this has been relieved and but a moderate discharge is left. The remedy is more beneficial when the membrana tympani is intact. The canal is filled with the solution, which is retained by cotton-wool.

With alkaloids tannic acid generally forms insoluble compounds; it should not, therefore, be prescribed with preparations containing salts of quinine, strychnine, etc.

Notwithstanding the chemical arguments urged by Dr. Stockman, tannic acid has long been successfully administered as an astringent remedy. As, however, it enters the blood under the form of gallic acid, its remote effects are, in reality, due to the latter acid. Tannic acid is preferably employed as a local application, gallic acid as a systemic remedy. The therapeutical uses of gallic acid have been already described, and need not be here repeated.

Tannic acid has been used in tuberculosis under the theory that it is able to destroy the bacillus of the disease. M. Arthaud has detailed the results obtained in two thousand cases from this method of treatment. He claims that the effect of tannin is superior to that of creosote.

ACIDUM TARTARICUM (U. S. P., B. P.).—**Tartaric Acid** ($H_2C_4H_4O_6$).

Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Preparations.—The U. S. P. official salts are antimony and potassium tartrate (tartar emetic), iron and ammonium tartrate, iron and potassium tartrate, potassium tartrate, potassium and sodium tartrate (Rochelle salt), and potassium bitartrate (cream of tartar). Seidlitz powder, or **pulvis effervescens compositus** (U. S. P.), **pulvis sodæ tartaratæ effervescens** (B. P.). is dispensed in two small papers, a blue one containing 8 Gm. (or 3ij) of potassium and sodium tartrate, with 2.60 Gm. (or gr. xl) of sodium bicar-

bonate, and a white one containing 2.25 Gm. (or gr. xxxv) of tartaric acid. When administered these are separately dissolved, each in about 60 c.cm. (or f℥ij) of water, and the two solutions mixed and drunk while effervescing. A slice of lemon improves the flavor of the dose.

Pharmacology and Physiological Action.—Tartaric acid is obtained by the decomposition of cream of tartar (potassium bitartrate) found in old wine-casks. It is laxative and slightly diuretic. It reduces the alkalinity of the blood and makes the urine acid. In larger doses it is an irritant; indeed, in its effects it resembles oxalic acid, and the morbid appearances are also very much the same. In excessive amounts tartaric acid retards and weakens the movements of the heart. Its saturated solutions are irritant even to thte skin. In a few instances death has resulted from the ingestion of this substance. The symptoms are best relieved by demulcents, the alkalies, magnesia, chalk, soap, milk, etc.

Therapy.—Certain of the tartrates are used as laxatives, magnesium tartrate affording a good substitute for the citrate. Rochelle salt, in 15.5 Gm. (or ℥ss) doses, before breakfast, is a good remedy for habitual constipation. Potassium bitartrate (in doses of 0.65 to 1.30 Gm., or gr. x-xx) exerts a decided diuretic action, and in combination with washed sulphur (1 to 2) it forms an excellent laxative remedy for hæmorrhoids.

The combination of diuretic and cathartic virtues renders potassium bitartrate very useful in the treatment of chronic Bright's disease. It relieves œdema and delays the manifestation of uræmia. For a similar reason it is useful in ascites. Potassium tartrate, or Rochelle salt, proves of utility in hepatic indigestion accompanied by an excess of uric acid in the urine.

Lithium bitartrate also is useful in lithemia and chronic rheumatism.

ACIDUM TRICHLORACETICUM (U. S. P.).—**Trichloracetic Acid** ($HC_2Cl_3O_2$).

Pharmacology and Therapy.—This acid, a crystalline and deliquescent substance, readily soluble in water, is an efficacious caustic and astringent. It has been successfully employed in the removal of enlarged tonsils, hypertrophied follicles of the pharynx, and polypoid excrescences. Its action can be more strictly limited than that of some other caustics, but it is too slow for use when large masses of tissue are to be destroyed. It can be applied to the pharynx without any previous anæsthetization. In the nares, however, the surface should first be touched with a 10-per-cent. and the larynx with a 20-per-cent. solution of cocaine. It is notable for the dryness of the eschar which it produces. Trichloracetic acid is a serviceable application to warts, vascular nævi, pigment patches, and indolent ulcers.

As an astringent, the following combination is recommended:—

℞ Iodi	15|5	Gm. or ℥ss.
Potassii iodid.	19|4	Gm. or ʒv.
Acidi trichloracetici	15|5 to 31|	Gm. or ℥ss-j.
Glycerini	60|	c.cm. or f℥ij.

M. Sig.: Apply to the affected surface on a pledget of cotton.

Dr. Adolph Bronner employs trichloracetic acid in the treatment of ozæna. He makes use of a 10- to 15-per-cent. aqueous solution and applies it to the mucous membrane covering the septum and turbinated bones.

The operation is repeated two or three times a week for several weeks. Cozzolino recommends the use of trichloracetic acid in epistaxis, touching the bleeding-point with a piece of cotton saturated in a solution of 1 Gm. (or gr. xv) of trichloracetic acid to 30 c.cm. (or f℥j) of water.

ACONITINA (U. S. P., B. P.).—**Aconitine.**
Average **dose**, 0.00015 Gm. (or gr. $^1/_{400}$).

ACONITUM (U. S. P.).—**Aconite.** (Monk's-hood.)

ACONITI RADIX (B. P.).—**Aconite Root.**

Preparations.

Fluidextractum Aconiti (U. S. P.).—Fluid Extract of Aconite. (100 c.cm. contains 0.4 Gm. of Aconitine.) Dose, 0.006 to 0.06 c.cm. (or $m^1/_{10}$-j).

Tinctura Aconiti (U. S. P., B. P.).—Tincture of Aconite (10 per cent.; assayed to contain in each 100 c.cm., 0.045 Gm. of aconitine U. S.). Dose, 0.06 to 0.30 c.cm. (or *m*i-v). B. P., 0.30 to 1.20 c.cm. (or *m*v-xx); if frequently repeated, 0.12 to 0.60 c.cm. (or *m*ii-x). (The U. S. P. formula is nearly twice the strength of that of the B. P.).

Unguentum Aconitinæ (B. P.).—Aconitine Ointment (2 per cent.).

Linimentum Aconiti (B. P.).—Liniment of Aconite (500 Gm. in 750 c.cm.). For external use, with caution.

Pharmacology.—The dried tuberous root of Aconitum Napellus (Ranunculaceæ), collected in autumn, yielding, when assayed by U. S. P. process, not less than 0.5 per cent. of aconitine. The British Pharmacopœia requires that the roots shall be collected from plants cultivated in Great Britain. Monkshood is a perennial plant indigenous to Europe, but sometimes cultivated here in gardens for its ornamental spike of blue flowers. All parts of the plant are poisonous, but the active principle, an alkaloid, **Aconitine,** exists in greater proportion in the root, associated with **pipraconitine** and **aconine.** (Napelline is probably identical with aconine.) Aconitine crystallizes in rhombic or hexagonal plates; is soluble in alcohol, ether, and chloroform, and in 3200 parts of water.

Dunstan and Cash have found that different samples of aconitine differ extremely as regards toxic properties. What has been termed "amorphous aconitine" contains but a very small proportion of true, or crystalline, aconitine, which is the official form. When aconitine is heated at its melting-point there is obtained a new alkaloid, which they proposed calling pyraconitine. This substance readily dissolves in acids, forming salts which can be crystallized. The solutions of these salts have a bitter taste, and are not toxic in small doses. When heated with diluted acids, or with water in a closed tube, pyraconitine and its salts are converted into benzoic acid and an alkaloid, which has been named pyraconine. Pyraconine is soluble in water and ether. It combines with acids to form crystalline salts.

All the species of aconitum are, as a rule, virulently active, but A. napellus is the only official one. The root of aconite in winter-time has been dug up in the garden and eaten in mistake for horse-radish, with fatal consequences. It is only necessary to be aware of this liability in order to effectually guard against the error. The aconite-root is premorse, and is not tapering throughout its length, as the root of armoracia is; it is also of

a brown color, and when scraped has a disagreeable odor, and does not give out the irritating vapor that is so characteristic of the latter.

Physiological Action.—The effects of aconite are those of its active principle, aconitine. Many researches have been made, but the results have differed so widely that it is evident the various investigators have worked with impure or different substances. In the physiologic investigation by Professors Cash and Dunstan,[1] the greatest care has been taken to insure the alkaloids used being chemically pure. They found that aconitine kills mammals by its action on the respiratory centre; diacetyl-aconitine has much the same action, but is not so powerful, while benzaconine and aconine are much weaker. On the heart, all have finally a depressing effect, but aconine, compared with the others, proved to be relatively harmless. It was found that atropine and digitalis exercised a certain amount of antagonistic effect to aconitine. The addition of the two diacetyl groups to aconitine slightly weakens its action, but produces no radical change. The removal of an acetyl group from aconitine, to form benzaconine, greatly reduces its toxic power and greatly alters many of its minor effects, although in a general way its depressing action on the respiration and temperature resembles that of aconitine; but it is no longer a strong heart-poison. Aconine is very much less poisonous, it has a curare-like action, and actually strengthens the heart and opposes the asequence and inco-ordination which aconitine produces. The introduction into its molecule of benzoyl, and still more of acetyl, to form the other alkaloids, heightens its lethal effects and modifies its action to a very remarkable degree. The authors also found that there is a certain antagonism in action between aconine and benzaconine, on the one hand, and aconitine, on the other. It should be mentioned here, in explanation of the difference in effect from different specimens of aconite, that the alkaloidal strength and the physiological activity of the plant are much affected by circumstances of its growth, the wild varieties being more poisonous than the cultivated. In this way the well-known differences in the activity of different specimens of the drug are explained. Murrell has called attention to the fact that English aconitine is seventeen times stronger than the German, while the French is variable, but generally between these. The crystalline variety (Duquesnel's or Merck's aconitine) is to be preferred when prescribing, on account of its uniform strength. Aconite reduces cardiac action and blood-pressure, diminishes excitability of cerebral centres, the sensory tract of the cord, and the peripheral terminations of sensory nerves. It also promotes the action of the skin and kidneys. The external application of preparations containing aconite has sometimes been attended by redness and the development of vesicles, pustules, and blebs. The internal use of aconite will occasionally produce profuse diaphoresis together with vesiculation and more or less itching.

Toxic Effects.—Theodore Cash[2] thinks that the uncertainty of aconitine is due to the mixture with the other alkaloids of aconite, which differ to a great extent in potency and physiological action. The difference in the lethal dose is shown by the following table:—

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[1] *British Medical Journal*, Nov. 11, 1899, p. 1365, from *Philosophical Transactions*.

[2] *British Medical Journal*, Oct. 8, 1898.

	RABBIT.	FROG.
Aconitine	0.00012 Gm.	{ 0.000586 Gm. March. 0.0014 Gm. July.
Benzaconine	0.0272 Gm.	0.284 Gm.
Aconine .....probably	0.28 Gm.	1.055 to 1.75 Gm.

per kilogramme of body-weight. Aconitine is about 200 times as toxic as benzaconine, and 2000 times as toxic as aconine. The aconitine, in small doses, slows and steadies the pulse, with a slight decrease of pressure; benzaconine has a like effect, in a much more marked degree, while aconine lacks this property. The first produces the characteristic tingling of the mucous membrane and impairs sensation, generally by its action on the peripheral sensory nerves. The other two have no such action. They all have a bitter taste, but the last is not so marked. Death from aconitine is primarily due to respiratory failure, although in small doses it at first stimulates the respiratory centre, then finally depresses it by paralyzing the sensory fibres of the pulmonary vagi. Benzaconine acts much like the above, except that it has very little effect upon the sensory nerves, while it depresses the motor group and also the muscle-fibres. It also lacks the antipyretic action of aconitine. Aconine is not such a cardiac depressant as are the two others, but, as above stated, actually strengthens the heart and opposes the asequence and inco-ordination which aconite produces; upon the motor system it is a decided depressant and acts like curare.

Applied to the skin or mucous surface, aconite first is slightly irritant, but this is soon followed by numbness, which may be accompanied by tingling sensations. If a bottle containing aconitine be held to the nose, painful irritation of nose and eyes results. In relatively large doses death occurs very promptly, and, if given hypodermically, the fatal result may follow in less than a minute, according to Wood. It is destructive to all forms of animal and vegetable life; sometimes very small doses produce extremely serious symptoms. A case of decidedly marked impression from a quantity equal to 0.18 c.cm. (or *miij*) of the tincture has been reported by Woodbury,[1] in which vomiting; loss of power of extremities, with paræsthesia and numbness; loss of sight, mild delirium, weak pulse, and threatened stupor and collapse occurred, life being saved apparently only by very prompt and vigorous treatment. The first symptom observed in a case of poisoning is burning or tingling in the mouth and throat, soon extending to the extremities, and sometimes over the whole body. The surface of the extremities is cool or clammy and numb, but at the same time the patients complain that they feel as if the limbs were flayed. Sight may be lost and hearing dulled, but ordinarily the intellect remains clear. Convulsions occur occasionally. The pulse becomes weak and variable; slight exertion may bring on a fatal syncope. The muscular strength is early affected, so that the patient is unable to stand. Owing to the lowering of the blood-pressure and the dilatation of the arterioles caused by the aconite, the heat of the body is at first brought, with the increased blood-flow, to the surface, and there the blood loses its heat by radiation and the temperature of the interior of the body is quickly lowered. The depression is accompanied by increase of perspiration, which

[1] "Proceedings of the College of Physicians of Philadelphia," third series, vol. x, p. 450.

still further reduces temperature. This occurs more obviously when there is pyrexia present than when the temperature is normal to begin with. Death results from failure of respiration generally, but it may occur suddenly from syncope, as already stated. Aconite, applied locally, first paralyzes the sensory nerves, beginning with the end-organs and ascending the trunk to the centre. The motor nerves are next affected. The reflex function of the cord is impaired. Uncertainty still exists, however, concerning the mode and order in which aconite affects the different portions of the nervous system. Ringer concludes, upon the basis of his and Dr. Murrell's experiments, that aconitine paralyzes all nitrogenous tissues, abolishing the functions, first, of the sensori-perceptive centre, acting next upon the nerves, and, finally, upon the muscles. Similarly, first the ganglia of the heart are attacked, next its nerves, and lastly its muscular structure. After a fatal dose has been taken the symptoms usually make their appearance very rapidly, and death may result in half an hour. The average time required to produce death is rather more than three hours, the longest case on record being five and a half hours.

Antidotes.—The antidotes to aconite are tannic acid, astringent infusions, alcohol, and ammonia. Digitalis appears to be the physiological antagonist to counteract the depressant effect upon the heart, or tincture of strophanthus may be substituted. The hypodermic injection of atropine also acts in the same manner. Inhalations of amyl nitrite, administered freely, appeared to save life in Dr. Elliott's case. The patient should be kept in a recumbent position, with his head lower than his feet, and be kept warm. The stomach-pump, artificial respirations, ether or alcohol, and tincture of digitalis or strychnine hypodermically, a hot pack, even faradization over the epigastrium and cardiac region, are each useful.

Therapy.—Locally, the benumbing effects of aconite have been utilized in the treatment of neuralgia, the best combination, probably, being the Baltimore liniment, or the linimentum aconiti et chloroformi (N. F.):—

℞ Tr. aconiti,
Chloroformi ..... aa 12|50 c.cm. or f℥ij, *m*viij
Liniment. saponis ..... 75| c.cm. or f℥iiss.
M. Sig.: POISON. For external use. To be applied, with friction, along the course of the affected nerve.

The oleate of aconitine (2 per cent.) has also been used with asserted good results for neuralgia. An ointment of aconitine is official in the British Pharmacopœia. This preparation contains 0.65 Gm. (or gr. x) to 26 Gm. (or gr. ccccx) of lard, the aconitine being dissolved in 5.20 Gm. (or gr. lxxx) of oleic acid before being rubbed up with the fat. Aconitine ointment will often assuage the pain of chronic rheumatism, gout, and myalgia. It serves the same purpose, also, in herpes zoster, but care must be taken, in this affection, not to apply it to the abrasions produced by rupture of the vesicles. The same ointment also affords relief in neuralgia of the skin, paræsthesia or pruritus, papular eczema, and prurigo. It must never be placed upon a raw surface.

Its control over the circulation places aconite in the first rank in the treatment of the fever process; in many cases we may get the best results if given in fractional doses (every ten, fifteen, or twenty minutes, give a teaspoonful of water from a tumbler in which 0.60 to 1 c.cm. (or *m*x-xv), of

the tincture has been dropped). This is invaluable in the treatment of the ephemeral fevers of childhood and hyperpyrexia attendant upon the exanthemata. In adults the results are also very positive; so that aconite has almost entirely taken the place of the lancet in the antiphlogistic treatment. Aconite, however, should be avoided in typhoid fever or other diseases of asthenic character.

In the early stage of inflammatory processes—pneumonia, pleurisy, pericarditis, peritonitis, erysipelas, rheumatism, meningitis—and in children's diseases, it modifies materially the severity of the symptoms, reduces temperature, and moistens the skin.

In the treatment of rheumatic iritis Dr. Jonathan Hutchinson recommends the tincture of aconite in 0.60-c.cm. (or *m*x) doses[1] three times a day (equivalent to tinctura aconiti, U. S. P., 0.30 c.cm., or *m*v), given in combination with alkalies and the iodide of potassium. He looks upon aconite as of service in mitigating the pain of carcinoma. It also serves a useful purpose in acute congestion of the brain. In spasmodic croup aconite relieves the dyspnœa within a few hours. Aconite has been recommended as a sedative in relieving the vomiting of pregnancy. It is asserted that aconite is an antidote to the sting of the scorpion.

Asthma, especially in children, and preceded by coryza, is generally benefited by the use of this remedy. Ringer states that a drop of the tincture, every hour, is useful in acute gonorrhœa. In coryza and quinsy, or acute tonsillitis, it is highly prized for its influence in shortening the course of the disease; and it has also been given to abort or prevent urethral fever after the use of instruments. It affords prompt relief in congestive dysmenorrhœa; and in amenorrhœa, produced by exposure to cold, it is often efficacious in re-establishing the flow. In facial neuralgia the extract may be given internally, in combination with quinine and a carminative, viz.:—

℞ Fluidextracti aconiti		25 Gm. or gr. iv.
Quininæ bisulphat.	4	Gm. or ʒj.
Piperin.		32 Gm. or gr. v.

Div. in pil no. xx.

Sig.: Give one every two hours until relieved, and then one every four hours as long as needed.

In migraine, or sick headache, it may be combined with cannabis Indica:—

℞ Tr. aconiti		12 c.cm. or *m*ij.
Tr. cannabis Indicæ	1	c.cm. or *m*xv.
Tr. cardamom. co.	q. s. ad 4	c.cm. or fʒj.

M. For one dose, to be repeated every hour, or two hours, until patient is relieved.

Tincture of aconite will relieve the pain of epididymitis and of other glandular structures, commencing with 0.32 c.cm. (or *m*v), to be followed by 0.13 c.cm. (or *m*ij) every half-hour until pain is relieved or the heart shows its effects by lowered rate and diminished arterial tension. In nervous palpitation and overaction of a heart somewhat hypertrophied, and in the tobacco-heart, aconite, when cautiously used, gives much relief.

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[1] The tincture of aconite of the British Pharmacopœia is only one-half of the strength of the tinctura aconiti of the United States Pharmacopœia.

Aconitine should never be given, even in the smallest dose, where there is a weak or fatty heart. It was used by Gubler in the treatment of facial neuralgia, and Seguin also advocated the crystallized aconitine in trigeminal neuralgia, in doses of 0.0002 to 0.00024 Gm. (or gr. $^1/_{300}$ or $^1/_{250}$), to begin with, repeated cautiously, and gradually increased until numbness is felt through all the body, with chilliness and, in some instances, even nausea and vomiting. Napelline has also been used in facial neuralgia in doses of 0.03 Gm. (or gr. ss), repeated every two hours until the pain has disappeared.

Tyson has employed the crystallized aconitine nitrate in the treatment of facial erysipelas, and reports that it almost invariably diminishes the duration of the disease and prevents the occurrence of complications. It is a very energetic salt, but it can be readily administered and regulated as regards dose by dissolving it in a mixture of distilled water, glycerin, and alcohol, having exactly the density of distilled water, so that 3.10 c.cm. (or *m*l) contain 0.001 Gm. (or gr. $^1/_{64}$). It may, therefore, be used in the dose of 0.00002 Gm. (or gr. $^1/_{3200}$): 1 minim of the solution. He usually adds 0.001 Gm. (or gr. $^1/_{64}$) of aconitine nitrate to a mixture, and gives it, in divided doses, in the course of twenty-four hours.

Aconitine cannot be regarded otherwise than as a dangerous remedy. It has been found that the toxic dose and the susceptibility both vary greatly in different subjects.

ADEPS (U. S. P., B. P.).—Lard.

Preparations.

Oleum Adipis (U. S. P.).—Lard-oil.

Adeps Benzoinatus (U. S. P.).—Benzoinated Lard (benzoin, 2 per cent. During hot weather 5 per cent., or more, of the lard should be replaced by white wax).

Adeps Benzoatus (B. P.).—Benzoated Lard (benzoin, 3 per cent.).

Pharmacology.—Lard is the prepared internal fat of the abdomen of Sus scrofa, Linné (class, Mammalia; order, Pachydermata), purified by washing with water, melting, and straining. The specific gravity of lard is about 0.938. It is entirely soluble in ether, benzin, and disulphide of carbon. It melts at or near 95° F. to a clear, colorless liquid. It consists chemically of 62 per cent. of olein, or fluid fat, and 38 per cent. of the hard fats, palmitin and stearin. The olein may be separated by pressure, or by the use of boiling alcohol. The salt with which it is frequently impregnated may be removed by boiling the lard with twice its weight of water. The tendency to rancidity is obviated by the addition of benzoin; it may also be overcome by digesting the lard with betanaphthol, or poplar-buds. As a convenient animal fat, lard is largely used in pharmacy as the basis of ointments and cerates; and in domestic practice it is universally employed as a lubricant. By the addition of benzoin it is prevented, not only from becoming rancid, but an agreeable odor is also imparted to it; dehydrated lard is preferred where the presence of water is considered objectionable. Lard-oil is sometimes used for illuminating purposes. It can be administered, in cases of corrosive poisoning, as an antidote, except where phosphorus or carbolic acid has been swallowed. Lard is an article of food, or, more correctly, is largely employed in preparing other articles of food.

Therapy.—Lard has more penetrating power than petrolatum or vaselin, and active agents (such as mercury or the alkaloids) can be combined with

it for administration by inunction. Washed lard, beaten up with an equal quantity of lime-water, and a few drops of oil of bitter almonds, thymol, or of carbolic acid added, makes an elegant substitute for carron-oil as a dressing for burns, or for some acute inflammations of the skin. Stiffened with a little yellow wax, it forms the simple ointment of the U. S. P. This preparation is well adapted to fulfill the general indications of a fat, and to serve as an excipient for more active ingredients. When the secretory functions of the skin are suppressed, inunction with lard serves as a partial substitute for the natural secretion, softens the hard tissue, and reduces its heat. It sheaths the surface, and prevents the contact of the atmospheric air with its floating germs. It lessens or prevents the effect of irritant discharges. Lard softens and removes scabs. The free application of simple ointment relieves the intense heat of the skin and itching in scarlatina, and at the same time it assists in reducing the pulse-rate and temperature of the body. Inunction is likewise of value in measles. It has been claimed that it is useful as an antidote to strychnine, and that a dog which has had a poisonous dose of strychnine will recover if given lard freely.

ADEPS LANÆ (U. S. P., B. P.).—Purified cholesterin-fat of sheep's wool.

ADEPS LANÆ HYDROSUS (U. S. P., B. P.).—**Hydrous Wool-fat.**

This is the purified fat of the wool of the sheep, mixed with not more than 30 per cent. of water. (Lanolin is a trade name for Adeps lanæ.)

Pharmacology.—In the washings of wool is found a variety of fat which, owing to the presence of cholesterin, combines readily with more than its own weight of water; it does not become rancid, and resists saponification. It is neutral and is a good vehicle for remedies to be used by inunction, as it passes readily through the skin; it is not adapted as a protective for this reason. The sheepy smell of the fat is removed by repeated washings, and pure lanolin is now obtainable that is nearly odorless.

Lanolin used as a medicament contains from 25 to 30 per cent. of water, which is not, however, chemically combined, and is readily separated by heat. Anhydrous lanolin is completely soluble in ether, benzol, and chloroform; sparingly soluble in stronger alcohol; and insoluble in water. Purified lanolin is of an unctuous, tenacious consistence and whitish color. Dr. A. Gottstein, of Berlin, has demonstrated that lanolin is indestructible or impermeable by micro-organisms. Its employment may, therefore, be regarded as an aseptic measure.

Physiological Action.—Lanolin has a soothing action on a delicate or irritable skin. It is not used internally, but only as an unguent.

Therapy.—Lanolin is a serviceable dressing in cases of burns, scalds, erysipelas, frost-bites, erythema, and dermatitis. Its property of absorbing water, its blandness and aseptic nature, render it an excellent medicament or base in acute eczema. In chronic eczema with infiltration and in psoriasis lanolin softens the skin and favors the action of remedies with which it may be combined. Lassar highly recommends it in the treatment of impetigo contagiosa. When suitably diluted and perfumed, it is an admirable toilet pomade. It rapidly heals chapped hands and lips, and may be spread upon the face before retiring at night in order to soften the skin after exposure to cold and wind. Lanolin, in conjunction with appropriate internal remedies, restores the lustre or gloss of the hair when it has been lost in consequence

of systemic disease. It is valuable in the treatment of atrophy of the hair, and counteracts that dry, harsh condition of the hair which is natural to some individuals. Senile atrophy of the skin may be benefited by the persistent and systematic use of lanolin. Inunction with this substance is one of the best means at our disposal for the obliteration of wrinkles. Lanolin favors the proper performance of the glandular functions of the skin, and is efficacious in anidrosis and comedones. In ichthyosis and scleroderma it softens the surface of the integument. It is an excellent vehicle for the parasiticides made use of in tinea versicolor, tinea favus, and the varieties of tinea trichophytina. It is admirably adapted to serve as an ointment basis for the oleate of mercury or copper in the treatment of the affections specified. On account of the ready miscibility of lanolin with mercury and its penetrative power, it is peculiarly serviceable in the inunction treatment of syphilis. In affections of the nasal and genito-urinary tracts, lanolin is of great advantage combined with cocaine hydrochlorate.

It is a good vehicle for the anodynes—atropine, cocaine, morphine, etc.—in cases of neuralgia or rheumatic joints. As an ointment alone for the eye, lanolin is too thick, tenacious, and sticky, and to remedy these defects a combination of 1 part of benzoinated lard to 3 parts of lanolin has been preferred; this makes a fine, smooth ointment, which has been found a good vehicle for eye ointments, and, even alone, is often used to apply at night to the eyelids in conjunctivitis and almost all external inflammations. Lanolin containing a large proportion of water is efficient in relieving the itching which accompanies measles, scarlet fever, and chicken-pox. The gradual evaporation of the water produces a cooling effect upon the skin. In these affections Dr. Klein adds to 31 Gm. (or ℥j) of pure anhydrous lanolin 12 Gm. (or ʒiij) of vaselin and 18.5 c.cm. (or fʒv) of distilled water. Liebreich recommends the injection of a lanolin cream into the bowel for the relief of inflammation and erosions of the rectum and hæmorrhoids. Lanolin seems to heighten the efficacy of many of the drugs for which it is employed as an ointment-base. This is especially the case as regards chrysarobin. Applied upon a bougie it has been found of advantage in the treatment of gonorrhœa.

ADHATODA JUSTICIA.[1] — **Adhatoda vasica, A. gendarussa, or A. pubescens.**

Pharmacology and Physiological Action. — The leaves of this plant (belonging to the Acanthaceæ, indigenous to India and neighboring islands) have been used with asserted benefit in pulmonary and catarrhal affections. It contains an alkaloid, **Vasicine**, combined with adhatodic acid. Hooper found it poisonous, when used in infusion, to flies, frogs, and all the smaller organisms, but harmless to large animals.

Therapy.—In asthma, 0.65 Gm. (or gr. x) doses of the powdered leaves, given three times daily, afford great relief, the patient being also permitted to smoke the leaves in a pipe, or to inhale the smoke. On account of its bactericidal properties, Dr. H. H. Rusby has recommended the use of adhatoda infusion in diphtheria, and it has been suggested that it might also be efficient in typhoid fever, and by inhalation of the spray from the atomizer in cases of phthisis and fetid bronchitis. It is prob-

[1] "Annual of the Universal Medical Sciences," 1890, vol. v, p. A-7.

able that it might also be useful in infectious dyspepsia due to the abnormal fermentation of food in the stomach.

ADONIS VERNALIS. — **False Hellebore,** or Pheasant's Eye, is a perennial herb (belonging to the Ranunculaceæ), indigenous to Europe, having bright, showy flowers. There are two annual species, the A. æstivalis, flowering in May, and the A. autumnalis, flowering in September; the former has orange, the latter red, flowers; hence the common name of red chamomile.

Physiological Action.—The active principle, **Adonidin,** appears to be a mixture, consisting of yellow **adonidoquercitrin, adonidodulcit, adonitic acid,** with a brown glucoside, and a bitter, poisonous glucoside, **pieradonidin,** according to the analysis of Podwissotzki. Adonidin is a yellowish-white, hygroscopic, bitter powder, devoid of odor, soluble in water and alcohol, insoluble in ether, chloroform, and benzin. Merck has isolated a crystalline principle termed **Adonite,** which has been shown to be a pentahydric alcohol, converted into a sugar by oxidation. Adonite is very soluble in water and has a slightly-sweet taste, but, according to Kobert, has no decided physiological action.

Whether used, as the peasants of Russia are said to be in the habit of doing, as an infusion, as the fluid extract, or in the form of adonidin, adonis acts upon the heart as a stimulant or cardiac tonic, resembling in its action digitalis or strophanthus. Adonis is said to increase the arterial tension and in large doses causes diastolic arrest of the heart. In large doses the first rise is succeeded by a decided fall of arterial pressure, with paralysis both of the heart and blood-vessels.

It is claimed that, in moderate doses, adonidin is devoid of danger from cumulative effect, and that it agrees well with the digestive organs. Huchard, however, found in some cases, that it caused vomiting or diarrhœa. In a case in which 0.20 Gm. (or gr. iij) of adonidin was taken by mistake, vomiting and diarrhœa were prominent symptoms. The action of this drug is very promptly manifested. In accordance with the observation that it increases arterial pressure, there is an increased flow of urine, but adonidin exerts no effect upon the secreting structure of the kidneys.

Therapy.—Internally in cases of mitral or aortic regurgitation it is claimed to be of great value. In functional irregularity of the heart J. M. Da Costa found much benefit from adonidin (in doses of 0.003 to 0.012 Gm., or gr. $^1/_{20}$-$^1/_5$, thrice daily). In cardiac asthma it also affords relief to the dyspnœa. The fluid extract (normal) is a good preparation in doses of 0.06 to 0.12 c.cm. (or *m*i-ij) cautiously increased.

Professor Bekhtereff has observed a favorable influence from the addition of adonis vernalis to a bromide solution in the treatment of epilepsy. The combination which he has for several years employed is:—

℞ Potass. bromid.	8	to 12	Gm. or ʒii-iij.
Tinct. adonidis	4		c.cm. or f3j.
Codeinæ sulph.		20	Gm. or gr. iij.
Aquæ	240		c.cm. or f3viij.

M. et ft. sol.
Sig.: Tablespoonful from four to eight times a day.

The tincture of adonis æstivalis, an allied species, in 0.60 c.cm. (or *m*x)

doses three times a day, is reported to be efficient in removing fatty tissues from the heart and relieving the dyspnœa which accompanies obesity.

ADRENALINUM.—**Adrenalin, Epinephrin.** (See **Glandulæ Suprarenales.**

ÆSCULUS HIPPOCASTANUM. — **Hippocastanum, Horse-chestnut.**

Pharmacology and Therapy. — The horse-chestnut, *Æsculus hippocastanum* (Hippocastaneæ), is a large tree cultivated in Europe and North America as a shade-tree; its original habitat was India. The bark contains tannic acid and two neutral bitter principles—**Æsculin** and **Fraxin.** Their effects are those of the vegetable bitters; the bark also has some antiperiodic powers. A fluid extract, with dilute alcohol, is the best preparation. The fluid extract has been administered in malarial disorders and in neuralgic affections in doses of 1.20 to 4 c.cm. (or *m*xx-f3j). *Æsculin* occurs in the form of brilliant, white crystals and is soluble in hot water. It is said to have been given with good result as a substitute for quinine in malarial fevers, especially of the remittent form.

ÆTHER (U. S. P., B. P.).—**Ether (Æther Fortior.,** U. S. P. 1880).

ÆTHER PURIFICATUS (B. P.).—**Purified Ether** [$(C_2H_5)_2O$].

Dose, 0.60 to 2 c.cm. (or *m*x-xxx) for repeated administration; for a single administration, 2.40 to 4 c.cm. (or *m*xl-lx).

Preparations.

Oleum Æthereum (U. S. P.).—Ethereal Oil. Equal volumes of ether and heavy oil of wine.

Spiritus Ætheris (U. S. P., B. P.).—Spirit of Ether. Dose, 0.30 to 2 c.cm. (or *m*v-xxx).

Spiritus Ætheris Compositus (U. S. P., B. P.).—Compound Spirit of Ether, or Hoffmann's Anodyne (U. S. P., composed of ether, 325 c.cm.; alcohol, 650 c.cm.; and ol. æthereum, 25 c.cm.). Dose, 0.30 to 2 c.cm. (or *m*v-xxx).

Spiritus Ætheris Nitrosi (U. S. P., B. P.).—Spirit of Nitrous Ether, or Sweet Spirit of Nitre. Dose, 2 to 4 c.cm. (or f3ss-j).

Pharmacology.—Ether is a liquid composed of about 96 per cent., by weight, of absolute ether, or ethyl-oxide, and about 4 per cent. of alcohol, containing a little water. "A volatile liquid prepared from ethylic alcohol by interaction with sulphuric acid. It contains not less than 92 per cent. by volume of ethyl-oxide. It was formerly termed sulphuric ether" (B. P.). Purified ether is: "ether from which most of the ethylic alcohol has been removed by washing with distilled water and most of the water by subsequent distillation in the presence of calcium chloride and recently-prepared lime" (B. P.). It is a thin, very diffusive, clear and colorless liquid, with a refreshing, characteristic odor, a burning and sweetish taste, aftertaste slightly bitter, with a neutral reaction. It is soluble in all proportions in alcohol, chloroform, benzol, benzin, fixed and volatile oils; dissolves in about ten times its volume of water at 59° F., and it boils at 98.6° F. It is very inflammable, and its vapor, mixed with air and ignited, explodes violently. The vapor is slightly irritating to the conjunctivæ, and at first to the bronchial mucous membrane.

Physiological Action.—When ether is poured over the skin it evaporates so quickly that a sensation of cold is experienced, and when its application is continued, as with the atomizer, the temperature of the part is lowered and it may be frozen, which is announced by sudden blanching of the skin. When the escape of the vapor is prevented ether acts as a counter-irritant, causing reddening; even vesication may be produced.

When taken internally, ether is a diffusible stimulant, resembling alcohol in its effects, which, although manifested earlier after ether, are more transitory. When introduced into the circulation, by absorption from the stomach or the rectum, by inhalation, or hypodermically, it is found temporarily to increase arterial tension and acts as a cardiac stimulant, the heart continuing to beat after failure of respiration. In these respects it is antagonistic to chloroform, which lowers arterial pressure and is a cardiac sedative. Ether-vapor is inhaled pure, while chloroform-vapor must be combined with 95 to 97 parts of atmospheric air. Upon the nerve-centres ether acts very much like alcohol, affecting (1) the cerebrum; (2) the sensory, and later the motor, functions of the spinal cord; (3) the sensory centres in the medulla oblongata; and (4) finally the motor centres in the medulla. Kemp[1] found a decided increase in the amount of indican excreted after ether, and by the use of the oncometer demonstrated a special contraction of the arterioles of the kidney, and damage to the secretory cells. Therefore the presence of albuminuria or pulmonary œdema is usually regarded as a sufficient contra-indication to its use.

The State of Anæsthesia.—Anæsthesia produced by the inhalation of ether-vapor, when complete, nearly approximates the state of coma. It approaches by well-defined stages, the first being one of excitement or exhilaration; the second is narcosis; the third is abolition of sensibility and reflexes, and, carried further, it ends in paralysis and death from failure of respiration, owing to paralysis of the centres in the medulla oblongata. The nerve-centres are affected in the following order: The higher centres in the brain, the motor and sensory centres in the medulla spinalis, and, ultimately, the sensory and motor centres of the medulla oblongata. The vapor of ether is at the beginning of the inhalation irritating to the air-passages, and may cause strangling sensations to the patient, but this soon passes away as anæsthesia becomes established; it may be necessary, at the outset, to allow some admixture of air, so as not to frighten the patient, but as soon as may be possible the pure ether-vapor is to be administered, so as to prevent efforts at vomiting. Owing to this irritation of the bronchial mucous membrane, there may be produced congestion or œdema of the lungs, especially when the patient is not kept warm during the operation, or pneumonia may follow.

The presence of bronchitis contra-indicates the use of ether. According to the observation of Poppert, œdema of the lungs is the frequent immediate cause of death from ether, and is due to the toxic influence of the anæsthetic. Senger draws attention to the danger of cerebral hæmorrhage during ether-narcosis, in patients suffering from arteriosclerosis. During operations upon the mouth, and particularly in the extraction of teeth, the blood running down the throat may cause asphyxia. A few "dont's" should be borne in mind when administering ether:—

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[1] *New York Medical Journal*, Nov., 1899.

1. Don't give it to a patient whose kidneys are diseased.

2. Don't give it when the stomach contains undigested food; the patient should be fasting for at least four hours, if possible.

3. Don't give it without removing artificial teeth from the mouth, which are liable to fall into the throat.

4. Don't give it unless the clothing is so loose as to allow freedom of respiration.

5. Don't give it when the pleural cavity is full of fluid.

6. Don't give any anæsthetic to women, especially young women, except in the presence of witnesses, who can testify as to your actions during the period of unconsciousness of the patient, as under such circumstances women sometimes acquire fixed delusions which can only be met by testimony absolutely proving their falsity.

7. Don't forget that ether-vapor and air make an inflammable and explosive mixture, and that ether may take fire from the actual cautery as well as from a candle.

8. Don't forget that there are different qualities of ether, and that the proper kind for surgical purposes is the official ether of the best make.

9. Don't forget that ether, like alcohol, lowers temperature, and that the patient should not be too much exposed to cold during operation.

10. Don't forget that ether causes death by respiratory failure, and that the color of the lips and ears is a better guide to the state of the blood than the radial pulse.

11. Don't forget that the anæsthetic state is a state of danger, and the patient is not safe until the effects of the ether have entirely passed off.

12. Don't forget that ether is eliminated rather slowly by the lungs and the kidneys; so the patient should be watched for several hours after the administration.

The Choice of Anæsthetics.—The anæsthetic agent should be suited to the operation and to the circumstances of each case. For many trivial operations, or those which are rapidly performed, pure nitrous-oxide gas is sufficient and much safer than the others. In young children chloroform-vapor is easier of administration than ether, and comparatively free from danger when properly administered. It also is preferred where the actual cautery is to be used, or where lights are required near the patient. In midwifery practice it also is the preferred anæsthetic. For all ordinary cases ether is safer than chloroform, and is by far the most frequently used.

A valuable paper has been published by Dr. Julliard,[1] of Geneva, upon the relative safety of ether and chloroform. From the records of several hundred thousand administrations of ether and chloroform it was shown that the mortality from the latter is from four to five times greater than from ether. Methylene bichloride has been tried in England to some extent, but as ordinarily sold it appears to be merely an alcoholic solution of chloroform. Ethyl-bromide is of more recent introduction, and when pure answers well for short operations, but does not have decided advantages over the best ether, except in having a slightly more agreeable odor. For a lengthy operation it is well to precede the anæsthetic by the administration of from 60 to 120 c.cm. (or f℥ii-iv) of whisky. In a similar manner an hypodermic injection of morphine 0.015 Gm. (or gr. $^1/_4$) and atropine 0.0005 Gm.

[1] *Revue Médicale de la Suisse Romande*, Feb., 1891.

(or gr. $^1/_{120}$) may be given before operating (Nussbaum's method). Various mixtures of anæsthetics have been proposed, the best known being the A. C. E. mixture of the London hospitals, containing alcohol, 1; chloroform, 2; and ether, 3 parts; but, owing to the different density and varying rates of diffusion, it is impossible to tell just how much of each is being given; therefore, these mixtures are not recommended. Gurlt finds that when a mixture of agents was used the proportion of accidents from asphyxia was greater than when chloroform alone was employed. By the use of an inhaler, ether-vapor mixed with oxygen can be administered, the gas passing through a wash-bottle containing the ether; by this method asphyxia is avoided and greater safety secured.

Where a patient dislikes ether, or takes it badly, the administration may commence with nitrous oxide and ether substituted later, or it may be preceded by a few whiffs of chloroform. Dr. A. Diaz de Liaño has invented an apparatus by means of which ether can be administered at a temperature of 88° F., and claims that by his method the disadvantages both of cold ether and chloroform are obviated. It is claimed by some clinicians that the preliminary application of cocaine solution to the nasal mucous membrane prevents irritation, and the unpleasant after-effects are, to a large extent, prevented.

The production of surgical anæsthesia by absorption of ether-vapor from the mucosa of the rectum was advocated by Pirogoff in 1847, and was prominently called to the attention of the profession by Axel Iversen, of Copenhagen, and Daniel Mollière, of Lyons. More recently, Stedman,[1] of the Sheffield Hospital, made a plea for this method. It is accomplished by attaching to a rectal tube a rubber pipe connected with a bottle, partly filled with ether, which is placed in a bucket containing warm water. The absence of irritation of air-passages, struggling, and vomiting by this method suggests its adoption in suitable cases. On the other hand, it is slow in action, requiring from five to thirty-five minutes, and it may be necessary to supplement it by ordinary inhalation. At least two deaths have been caused by rectal etherization. In another case, death resulted from rupture of the intestine at the site of an old cicatrix from an ulcer which yielded under pressure of the vapor. Calderon[2] believes ether-narcosis by the rectum to be of special service for surgical operations about the head, and reports a mastoid operation done successfully upon a child with its aid.

What is called "primary anæsthesia" occurs early in the administration of the ether, at the time when narcosis begins. During this stage, which is very brief, small operations, incisions, punctures, etc., may be done without waiting for complete anæsthesia. In order to ascertain when it occurs, the patient is directed to extend one of his arms perpendicularly upward and to hold it up as long as he can. At the moment when narcosis occurs the arm falls, which is the signal for the operator to cut and for the administration of ether to cease. The patient regains consciousness at once, and generally there is no vomiting or other ill effects.

Treatment for Toxic Effects.—When a patient appears asphyxiated, rhythmical traction upon the tongue by Laborde's method, artificial respiration, inhalation of ammonia, slapping the exposed surface of the chest with wet towels, and the application of the faradic current to the epigastric

[1] *Quarterly Medical Journal*, Sheffield, Jan. 18, 1895.
[2] *Pacific Medical Journal*, March, 1900.

region will usually restore him. Rubbing the body so as to keep up the circulation, or the use of stimulating enemata, is also of service. Oxygen might be administered, or a mixture of oxygen and nitrogen monoxide (2 to 1), or amyl nitrite cautiously inhaled so as to flush the brain and medullary centres with blood. Nitroglycerin, 0.0006 Gm. (or gr. $^1/_{100}$), may be given hypodermically.

Ill Effects of Ether.—The unpleasant results which sometimes follow the administration of ether, such as nausea and vomiting, may be overcome by giving the patient a cup or two of either strong, hot coffee or tea. After abdominal operations, where it is especially important to prevent vomiting, surgeons now prohibit the administration of any food, medicine, or water by the mouth, for a period of 12 to 24 hours, or longer. Thirst can be relieved by injections of water into the rectum, and strength sustained by nutritive enemata. Suppositories or small hypodermic injections of morphine may be given to relieve pain. For dental operations, ether is preferred to chloroform, on account of greater safety. In the event of nausea, vomiting, or even wakefulness supervening after extracting teeth, Dr. Dorr administers about 1.60 Gm. (or gr. xxv) of potassium bromide in strong coffee, or from a few minims to 4 c.cm. (or f℥j) of compound spirit of ether in water.

The author can also commend sodium bromide (1 to 1.30 Gm., or gr. xv-xx, in soda-water, soda-mint-water, or cinnamon-water), camphor-water, the aromatic spirit of ammonia, caffeine citrate or hydrobromate (0.065 to 0.25 Gm., or gr. i-iv, at a dose), tincture of capsicum (0.60 to 1.20 c.cm., or *m*x-xx, at a dose), or the effervescent salts of sodium or caffeine bromide, all of these being especially suitable for the treatment of the ill effects following the administration of ether. In order to control hiccough and vomiting during anæsthesia, Dr. Bernard Joos is in the habit of making digital compression of the phrenic and vagus nerves against the sternal end of the clavicle. He states that, as a rule, vomiting immediately ceases. The pressure is continued for a few moments in order to prevent a return of the sickness. J. Frederick Silk's[1] conclusions on "ether pneumonia" are: 1. Ether inhalation is only one of the minor exciting causes of croupous pneumonia. The stimulating properties of the vapor may even help to ward off an attack. 2. Catarrhal conditions of the mucous membrane of the air-passages are universal under ether, and their tendency is to subside on withdrawing the vapor. In a small proportion of cases, however, an inflammatory condition is produced, and the patient's life is in jeopardy. Other concomitant causes will then generally be found at work: *e.g.*, cold and exposure. 3. To limit this tendency, careful precautions will usually suffice, especially in the direction of avoiding exposure, cold, and draughts.

Therapy.—Ether may be used locally for its refrigerating or detergent effect before a surgical operation. It dissolves fat from the skin, and is utilized in disinfecting the hands by surgeons, in connection with antiseptics. The ether-spray may be used to benumb a part of the skin before making an incision; and, in chorea, ether-spray has been applied to the spine with good results. The ether-spray is also often very serviceable in allaying the pain of neuralgia, especially when seated in a superficial structure. The ether is directed immediately upon the course of the aching nerve. Sir

[1] *Practitioner*, March, 1900.

James Sawyer points out that ether is the best menstruum for the solution of many remedies to be used upon the skin; ether being a good solvent of the active principles of many drugs and also of sebaceous matter. It may be used as a menstruum for making ethereal tinctures or liniments. In strangulated hernia, 30 to 60 c.cm. (or f℥i-ij) of ether may be sprayed upon the tumor, as successfully employed by Finkelstein[1] and Gusenbauer, or allowed to fall upon the surface drop by drop.

Dr. Charles E. Hughes, of St. Louis, has had good effect from lavement with ether for the relief of pain; thus, in severe headache he has poured ether on the scalp freely with prompt cure.

A case in which a fistula remained after an operation for cholecystotomy has recently been described by Dr. John W. Walker. Seven months later a stone again entered the duct and was dissolved by a mixture of equal parts of ether and glycerin placed in a small glass tube attached to a syringe, the tube pressed directly upon the stone and the ether-glycerin injected drop by drop.

Ethereal preparations may be used internally for hysteria, colic, and the passage of biliary or renal calculi. Durand's remedy for gall-stones is equal parts of ether and turpentine-oil, given a teaspoonful at a dose.

Ether is a diffusible stimulant, and can be used hypodermically in heart-failure (1.20 to 2 c.cm., or *m*xx-xxx). Taken with water or syrup (2 to 4 c.cm., or f℥ss-j), it affords relief in flatulence, spasmodic asthma, or colic. It has similar effects to those of alcohol, and a habit of ether-drinking[2] has in like manner been established in some persons (although the odor of the breath plainly announces to others the fact that it has been taken), but its effects are more transitory than those of alcohol.

The internal administration of ether is capable of relieving mild attacks of angina pectoris. It is a good plan to combine 0.60 to 1.20 c.cm. (or *m*x-xx) of ether with codliver-oil when the latter substance is not well borne. Ether facilitates the digestion and absorption of the oil, probably by increasing the secretion of pancreatic fluid. Hoffmann's anodyne in 2 c.cm. (or f℥ss) doses is useful in sick headache. The hypodermic injection of from 1 to 2 c.cm. (or *m*xv-f℥ss) of ether in the neighborhood of the affected nerve has proved of value in sciatica, gastralgia, and various forms of rheumatic neuralgia. Barth obtained very excellent results in typhoid pneumonia from these subcutaneous injections of ether. The injections were given from two to four times daily, and were followed by notable increase in the strength and volume of the pulse. Castel reports favorably of the same method in small-pox. After puerperal, pulmonary, or other severe hæmorrhage ether thrown under the skin stimulates the heart and may avert fatal syncope.

The following combinations of ether will be found serviceable:—

℞ Spt. ætheris comp. ..... 60 | c.cm. or f℥ij.
Tinct. capsici ..... 4 | c.cm. or f℥j.
Spt. ammon. aromatic ..... 12 | 25 c.cm. or *m*cc.
Mist. sodæ et menthæ (N.F.) ..... 60 | c.cm. or f℥ij.

M. Sig.: A teaspoonful in water every few minutes until relieved. This prescription is especially useful in the treatment of syncope, flatulence, and nervous or hysterical paroxysms.

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[1] "Treatment of Strangulated Hernia by Applications of Ether, after the Method of Finklestein." *Gazette Médicale de Strasbourg*, No. 3, March 1, 1895.

[2] See interesting address on "Ether-drinking, its Prevalence and Results," by Ernest Hart, delivered before the Society for the Study and Cure of Inebriety, in the *Provincial Medical Journal*, Nov. 1, 1890.

℞ Spiritus ætheris comp.,
Fluidextracti lupulini,
Tinct. valerianæ ammoniatæ..... aa 30| c.cm. or f℥j.

M. Sig.: Two teaspoonfuls in water every fifteen or twenty minutes. For hysteria and nervous sick headache, neurasthenia, angina pectoris, and spasmodic asthma.

The diagnostic use of ether anæsthesia is frequently illustrated in surgery, where it is employed in order to examine fractures, explore cavities for morbid growths or foreign bodies, and to detect malingering. Emerson E. Sutton has suggested the employment of ether-vapor, in place of hydrogen in Senn's method of determining the presence of perforations in the intestines, after laparotomy, for gunshot wounds.[1]

Spiritus Ætheris Compositus (U. S. P., B. P.). — In hysteria, flatulent colic, and nervousness this solution is much in demand. Compound spirit of ether is likewise very serviceable in the treatment of hiccough, functional palpitation of the heart, or syncope. It will often afford relief in gastralgia, and will sometimes prove of marked benefit in angina pectoris. It is a diffusible stimulant and antispasmodic, and is popularly known as Hoffman's anodyne.

The following formulæ, containing compound spirit of ether, are useful:—

℞ Sodii bicarbonatis ..... 6| Gm. or 3iss.
Spt. ammon. arom.,
Tinct. zingiberis ..... aa 4| c.cm. or f3j.
Spiritus ætheris comp. .....120| c.cm. or f℥iv.

M. Sig.: Two teaspoonfuls in water for hysteria or flatulence. Repeat when necessary.

℞ Spiritus ætheris comp..... ..... 30| c.cm. or f℥j.
Vini cocæ .... 60| c.cm. or f℥ij.

M. Sig.: From one-half to a tablespoonful, in water, every hour or two, as a stimulant, in hysteria, dysmenorrhœa, or flatulent colic.

Spiritus Ætheris Nitrosi (U. S. P., B. P.), spirit of nitrous ether, popularly known as sweet spirit of nitre, is an alcoholic solution of ethyl-nitrite, yielding, when freshly prepared and tested, not less than 4 per cent. of ethyl-nitrite. It is made by the action of sulphuric acid upon sodium nitrite, potassium carbonate, water, and alcohol.

The pharmacopœias direct that it should be kept in small, glass-stoppered bottles, in a dark place remote from lights or fire. Very much of the spirit of nitrous ether dispensed is deficient in strength, and has become acid from age. When this has occurred it should not be used. The loss of the ethyl-nitrite is prevented, to a large extent, by a combination with an alkali or ammonia acetate or citrate. When fresh, it renders excellent service in teaspoonful doses, well-diluted, given several times a day, in scanty secretion of urine in elderly people.

Nitrous ether resembles the other nitrites in its sedative effects upon the system, but its action is overcome or modified in this form by the comparatively large quantity of alcohol accompanying it, which really makes the spirit of nitrous ether a diffusible stimulant. For this reason Whitla

[1] *Journal of the American Medical Association*, July 23, 1898.

especially commends it in the dropsy of debilitated subjects. In fever it may be given in cold water or lemonade, or in combination with other remedies, as aconite or veratrum viride. It acts upon the skin as well as upon the circulation, and reduces the temperature. It is useful, above all, in the febrile affections of infancy and childhood. It enters into Brown mixture (Mist. glycyrrhizæ co.), of which it constitutes 3 parts in 100, forming a popular remedy for acute bronchitis, and which is used as a vehicle for quinine and other remedies.

Spirit of nitrous ether can be employed in the following combinations with advantage:—

℞ Spiritus ætheris nitrosi,		
Aquæ camphoræ,		
Liq. ammon. acetatis	aa 60	c.cm. or fʒij.
Antimonii et potassii tart.	.065	Gm. or gr. j.
Morphinæ sulphatis	.03	Gm. or gr. ss.

M. Sig.: A tablespoonful in water every hour or two until relieved. For acute bronchitis, acute rheumatism, and in fevers.

℞ Spiritus ætheris nitrosi,		
Elix. humuli (N.P.),		
Syr. lactucarii	aa 60	c.cm. or fʒij.

M. Sig.: From a half to a tablespoonful every hour when unable to sleep. Serviceable in insomnia, general nervousness, and debility.

ÆTHER ACETICUS (U. S. P., B. P.).—**Acetic Ether.**

Dose, internally, 0.60 to 2 c.cm. (or *m*x-xxx).

Acetic ether is a liquid composed of about 90 per cent., by weight, of ethyl-acetate ($C_2H_5C_2H_3O_2$) and about 10 per cent. of alcohol containing a little water (U. S. P.). It is soluble in 10 parts of water (at 59° F.), and mixes in all proportions with alcohol, ether, chloroform, and fixed or volatile oils. It enters into cologne water (spiritus odoratus, U. S. P. 1890). It has similar effects upon the system to ethyl-oxide, and also can be used by inhalation as an anæsthetic, but is slower in its action.

According to the experiments of Krautwig on rabbits, moderate quantities of acetic ether greatly increase the respiratory capacity, the effect augmenting in proportion to the dose. There was no influence from the same quantities upon the blood-pressure and no ill effects upon the heart. Inhalation of the vapor of acetic ether allays laryngeal and bronchial irritation. In spasmodic asthma and in nervous cough also it may be used with good effect. It is rather more irritating to the skin than ordinary ether.

ÆTHER VALERIANICUS.—Valerianic Ether.

Pharmacology and Therapy.—Valerianic ether, or the ethylic ether of iso-valerianic acid, is a colorless fluid, having an odor resembling that of valerian. It is a less volatile fluid than ordinary ether. The dose of valerianic ether is 0.12 c.cm. (or *mij*), but in practice it is found preferable to dilute it with sulphuric ether, and it is thus prepared and put up in sealed gelatin capsules, each capsule containing about 4 drops. Valerianic ether is a serviceable remedy in dysmenorrhœa, nervous headache and excitement, asthma and other spasmodic disorders, neuralgia, and nervous vomiting. It is of advantage in mania a potu, by controlling arterial and nervous ex-

citement and tremor. In periodic hay fever, Dr. J. D. Christman, of Allentown, Pa., found it decidedly useful.[1]

ÆTHYLIS BROMIDUM.—**Hydrobromic Ether**, or **Ethyl Bromide** (C_2H_5Br). (It must not be confounded with **Ethylene Bromide.**)

Pharmacology.—This liquid has rather a pleasant odor and sweetish taste. When pure it is colorless, volatile, non-inflammable, and resembles ether or chloroform in its effects when taken internally or by inhalation. It is very slightly soluble in water, but freely soluble in alcohol and ether, chloroform and oil. Air and moisture cause its decomposition. Under the influence of light the bromine gradually separates, causing discoloration of the ethyl, when it becomes unfit for use, owing to the poisonous effects of bromine.

Therapy. — For anæsthesia, the pure ethyl bromide only should be used, as dangerous symptoms, even fatal results, have been ascribed to the use of impure preparations. It is thought that some, at least, of the fatal cases may have been caused by the employment of ethylene bromide in mistake for ethyl bromide. An easily applied test for the purity of ethyl bromide is given by Sternberg: if a drop of ethyl bromide be let fall in a solution of potassium iodide 3 centimetres (about $1\,^1/_4$ inches) deep, it should reach the bottom without being colored violet. In experiments upon animals, ethyl bromide has generally proved fatal by arrest of respiration. Kochler, however, has reported a case in which death occurred from a sudden cessation of the heart's action. Chemical examination demonstrated that a pure sample had been employed. In other cases, which did not terminate fatally, the inhalation of ethyl bromide occasioned nausea, vomiting, collapse, spasm of the glottis, cyanosis of the face, or other distressing symptoms. In some instances irritability of the stomach, loss of appetite, and prostration continued for days after the anæsthetic had been given.

In dosage, it stands between ether and chloroform, and probably occupies the same relative position with regard to safety. Its characteristic effects, when inhaled, are the rapid approach of anæsthesia, its brief duration, and the rapid return of consciousness. It is, consequently, ill adapted for use in prolonged operations. When sprayed upon a part it produces local anæsthesia. It may be inhaled in epilepsy, chorea, and other spasmodic diseases (about 4 c.cm., or f℥j, at a time). Not very inflammable and not unpleasant, it may be used instead of ether for minor surgical operations. One advantage which ethyl bromide possesses is that it does not irritate the mucous membrane of the upper respiratory tract. This agent is not appropriate for use in the reduction of fractures and dislocations, as it is liable to excite muscular spasm. It is regarded as unsafe in the case of drunkards and those suffering from disease of the kidneys, heart, or lungs.

From a series of experiments relative to the action of ethyl bromide, L. Guinzbourg concludes that small quantities produce narcosis without affecting arterial pressure. Large amounts diminish blood-pressure by paralyzing the peripheral vasomotor constrictor system. It is without effect upon the central vasomotor dilator system or upon the vagi. Toxic

[1] *Medical Bulletin*, Jan., 1892.

doses disturb the action of the heart, but, as a rule, produce arrest of respiration before that of the heart. The same precautions should be taken in administering ethyl bromide as when giving chloroform.

Coryl.—Under this name a mixture of methyl chloride and ethyl chloride has been employed as a local anæsthetic in dentistry and minor surgery. Though it does not produce as much cold as methyl chloride, it has the advantage of being a fluid at 32° F., while the latter boils at a much lower temperature.

Ethylene Bromide. — This fluid has at first a sweetish and subsequently a burning taste, and an odor which resembles that of chloroform. It dissolves in water and mixes with oil or alcohol. Ethylene bromide has been used with success in a number of cases of epilepsy as a substitute for potassium bromide. It contains 90.9 per cent. of bromine. The dose for adults is from 0.18 to 0.5 c.cm. (or *m*iii-viij) thrice daily, and can be gradually and cautiously increased to 2 c.cm. (or f3ss) two or three times a day. It can be administered in wine or in capsules. It is never used by inhalation.

ÆTHYLIS CARBAMAS (U. S. P.).—**Ethyl Carbamate, or Ethyl Urethane** ($CONH_2OC_2H_5$). This is an ester of carbaminic acid, obtained by the reaction of alcohol upon urea or one of its salts (U. S. P.). It can also be obtained by the action of ammonia or ethyl carbonate, or chlorocarbonate, and likewise by direct union of cyanic acid with ethyl alcohol. Ethyl carbamate, or urethane, is in the form of tasteless, white crystals, which are soluble in water, alcohol, ether, chloroform, and glycerin. The aqueous solution is of a neutral reaction.

Physiological Action.—Von Jäksch[1] found it markedly hypnotic in doses of 0.50 to 1 Gm. (or gr. viiss-xv) in various pathological conditions. Urethane is not an analgesic, and does not relieve the neuralgic pains of locomotor ataxia, for instance. Urethane resembles paraldehyde in being free from any decidedly depressing action upon the circulation and respiration, differing in this important respect from chloral hydrate, and its allies. When the circulation is weak, urethane is to be preferred as a hypnotic, instead of chloral, although the latter has a stronger hypnotic action (Cushing). Overdoses, however, cause distinct depression of the spinal cord, heart, and respiration. Death from a fatal quantity is caused by asphyxia.

Therapy.—In adults it is recommended for use as a sedative and hypnotic, where other agents cannot be used, in doses of 1 Gm. (or gr. xv), every two hours. Demme regards it especially suited to children, giving 0.25 Gm. (or gr. iv) at the age of 1 year as a true hypnotic. He considers that larger doses are safe even in weakly children, as he has seen no effect upon the circulation, respiration, digestion, or nerve-centres. As an enema, he used it successfully in eclampsia. It may also be given in solution hypodermically in doses about one-fourth of those for ordinary use. Abbott reports a case of tetanus cured in two days, from 0.58 Gm. (or gr. ix) of urethane every two hours, with 2 Gm. (or gr. xxx) administered at night. Maresti, also, successfully treated a case of tetanus by means of urethane. Prof. J. P. Crozer Griffith looks upon urethane in ordinary doses, as an un-

[1] "Jahresbericht der Pharm. Therap.," 1885.

certain and unreliable hypnotic, though in large doses it may at times prove useful.[1] Chloral and urethane may be combined, forming **Chloral-urethane,** an alcoholic solution of which is known as **Somnal.** **Uralium**[2] is a similar substance to, if not identical with, somnal. Uralium is a crystalline substance, soluble in alcohol and ether, but insoluble in cold water. It has been given as an hypnotic in doses varying from 1 to 3 Gm. (or gr. xv-xlv).

ÆTHYLIS CHLORIDUM.—**Chloric Ether,** or **Ethyl Chloride** (C_2H_5Cl). Ethyl chloride is a colorless fluid of ethereal odor, and boils at 50° F. It produces local anæsthesia by its rapid evaporation. The skin is first reddened, after which it becomes perfectly white, and a snow-white coating forms upon its surface. Ethyl chloride is put up in hermetically-sealed glass tubes containing 9.25 c.cm. (or f3iiss), one end being drawn out into a fine point. When this is broken off the heat of the operator's hand projects a fine spray upon the surface to be anæsthetized. Ethyl chloride has been used successfully to allay the pain of neuralgia, lumbago, and migraine. It has also been found serviceable in minor surgery and dentistry. Commercially, it is supplied under the name of "Kelene," by which name it is known in Europe. Ethyl chloride has also been employed for general anæsthesia, but it is less safe than ether. A death has been reported from 6 c.cm. by George K. Gifford.[3]

ÆTHYLIS IODIDUM.—**Hydriodic Ether,** or **Ethyl Iodide** (C_2H_5I). This is very analogous to ethyl bromide, iodine merely replacing the bromine. It can be administered from a vial in drops on a handkerchief or by gelatin capsules containing 0.30 c.cm. (or *m*v) each. It is not used for producing anæsthesia, but may be cautiously inhaled for syphilis, bronchitis, phthisis, catarrh, whooping-cough, asthma, or other spasmodic disorders. Dose, 0.3 to 1.2 c.cm. (or *m*v-xx), by inhalation.

AGARICUS ALBUS.—**Purging Agaric.** (Polyporus officinalis, Boletus laricis; order, Basidiomycetes, Hymenomycetes.) The European larch has a fungus which grows in large, hoof-shaped masses horizontally from the trunk, and penetrates, with its mycelium, deeply into the wood. The masses are collected in Europe and Asia Minor, and, after peeling and drying, they form yellowish-white, friable, spongy, irregular balls, from the size of an orange up to that of a cocoa-nut. It has a heavy, fungus-like odor; a sweetish, followed by a bitter, nauseous taste; and its powder is irritating to eyes and nose. It largely consists of resinous matter, **Agaricin.** In doses of 0.65 Gm. (or gr. x) or more it acts as a purgative; in small doses is tonic and anhydrotic.

Physiological Action.—In small doses (0.065 to 0.32 Gm., or gr. i-v) agaricin acts like atropine, but does not dilate the pupil. It is a compound body, the active principle of which is termed agaricic acid. Hoffmeister has shown that the substance usually employed under the name of agaricin or agaric acid is an impure product. Pure agaric acid is a white, light, crys-

[1] "Annual of the Universal Medical Sciences," 1899, vol. v, p. A-150.

[2] *Gazzetta degli Ospitali*, Milan, Feb. 6, and *British Medical Journal*, March 16, 1890.

[3] *British Medical Journal*, July 8, 1905.

talline powder, of a silky lustre. It crystallizes out of absolute alcohol in groups of tuft-like needles or as distinct rosettes. Its melting-point is 138° C. (280.4° F.). The free acid is but slightly soluble in cold water, but is moderately soluble in boiling water. Its alkaline combinations are freely soluble, but its heavy metallic salts are insoluble. It is a strong local irritant, and its subcutaneous injection results in active inflammation, with the production of pus. On account of its slow absorption, it produces no grave symptoms in warm-blooded animals. The subcutaneous or intravenous injection of a soluble salt first excites, and then paralyzes, the vagus and vasomotor centres. Death is preceded by convulsions, and results from cessation of respiration or, in animals when artificial respiration is kept up, from the extreme fall of blood-pressure. The influence upon the secretion of sweat is not central, but is exerted upon the secretory glands.

Therapy.—Agaricin, in doses of 0.005 to 0.065 Gm. (or gr. $^1/_{12}$-j), is used to check night-sweating, and sometimes to suppress lactation.

℞ Agaricin. ..... .065 Gm. or gr. j.
Acid. sulph. aromat. ..... 15 c.cm. or f℥iv.
Elixir ..... 45 c.cm. or f℥iss.

M. Sig.: Take one drachm every four hours in water.

Agaricin also suppresses perspiration due to other morbid causes. A solution of agaricin in alcohol has been suggested as of value in hyperidrosis. It has also been recommended to combine a small quantity of Dover's powder with each dose of agaricin, when there is a tendency to looseness of the bowels following its use.

In order to reduce the fever and restrict the night-sweats of pulmonary tuberculosis, Dr. J. M. Anders sometimes resorts to the following combination:—

℞ Quinin. sulphat.,
Antipyrin. ..... aa 1.55 Gm. or gr. xxiv.
Agaricin. ..... .10 Gm. or gr. iss.

M. et ft. capsulæ no. xij.
Sig.: One capsule three times a day.

AGARICUS CHIRURGORUM.—**Polyporus Igniarius** is an allied fungus to the preceding, but is used solely on account of its porous texture. It has been employed as a mechanical hæmostatic and for its slow burning as a moxa. It may be soaked in potassium nitrate or chlorate solution, which makes it more inflammable.

AGARICUS MUSCARIUS.—**Amanita Muscaria,** or **Fly-fungus** (Basidiomycetes, Hymenomycetes), is a poisonous mushroom, consisting largely of fungus-cellulose. Its active principle is a syrupy alkaloid, **Muscarine** It is without taste or odor, but produces powerfully-intoxicating effects somewhat analogous to pilocarpine in its action, and antagonized by atropine. Amanita Verna, or Phalloides, allied species of mushrooms, are very poisonous. In addition to **muscarin,** they contain **phallin,** and also a third principle, which has not been isolated. For the latter two elements no anti-

dote has been found. They act like serpent-venom, in causing solution of red blood-cells. Treatment of mushroom-poisoning should commence with evacuants to clear the alimentary canal; then use atropine and diffusible stimulants. Digitalis may also be given hypodermically, and stimulating enemata administered.

Physiological Action.—The action of the heart and of the lungs is diminished by large doses of agaric, the heart being finally arrested in diastole. Smaller doses diminish blood-pressure and reduce temperature, although the bodily heat may be secondarily increased. The secretions of the skin, the liver, and intestinal tract are increased, while that of the kidneys is sometimes reduced or suppressed. The muscular system is relaxed, but convulsions may occur from accumulation of carbonic acid in the blood. Upon the brain a marked narcotic or stupefying effect is observed, so that it has been used in Asia as an intoxicant. The pupil contracts from the effects of the internal administration, while the local application of muscarine may cause dilatation.

Therapy.—Administered medicinally, muscarine has some reputation in checking the fever and sweating of phthisis. It may be used in affections of the respiratory tract where there is a deficiency of secretion or in disorders of the alimentary canal where the same indication is to be met, and to overcome a tendency to constipation. Muscarine can therefore be combined with such drugs as belladonna, hyoscyamus, strychnine, aloin, cascara sagrada, or sulphur, with advantage, as in the following formula:—

℞ Muscarinæ		20 Gm. or gr. iij.
Ext. nucis vomicæ		065 Gm. or gr. j.
Aloini,		
Ext. belladonnæ folior	aa	10 Gm. or gr. iss.
Ext. gentianæ		1 Gm. or gr. xvj.

M. et ft. pil. no. xvj.

Sig.: One pill two or three times a day. Beneficial in constipation and in catarrhal jaundice.

The dose of muscarine is usually 0.008 to 0.13 Gm. (or gr. $^1/_8$-ij), in solution, or muscarine nitrate may be given in somewhat smaller doses. For the sweating of phthisis, Murrell uses a 1-per-cent. solution, of which the dose is 0.30 c.cm. (or *m*v).

AGATHIN is the name bestowed upon a new synthetical compound discovered by Dr. Israel Roos, of Frankfort-on-the-Main. It is a derivative of salicylic acid, and its chemical composition is expressed by the title "salicyl-aldehyde-methylphenylhydrazin."

Agathin occurs in the form of small, light-green, crystalline scales, destitute of smell or taste, insoluble in water, soluble in alcohol and ether, and melting at 74° C. (165° F.).

Physiological Action and Therapy.—Moderate doses have no ill effect upon animals. When administered to the human subject, agathin generally increases the appetite and excretion of perspiration. It has been found beneficial clinically in neuralgia and rheumatism, being generally given in the dose of 0.50 Gm. (or gr. viij) two or three times a day. Its effect is not immediately exerted, and its use, it is claimed, does not usually appear to be accompanied by any drawbacks. On the contrary, Ilberg and Badt have observed cases in which agathin gave rise to headache, vertigo,

insomnia, vomiting, diarrhœa, thirst, sensation of heat, and smarting pain during micturition.

AILANTHUS GLANDULOSA.—Ailanthus-tree, or **Chinese Sumach.** The Ailanthus, or Tree of Heaven (belonging to the natural order Simarubaceæ), brought from China, is now naturalized in this country, and, being ornamental, is used as a shade-tree. The inner bark, which is the part used, contains an oleoresin and a volatile oil.

The fluid extract (0.60 to 4 c.cm., or *m*x-f℥j) and the tincture (in doses of 2 to 7.5 c.cm., or f℥ss-ij) have been used. The bark may be given in doses of from 0.32 to 0.65 Gm. (or gr. v-x).

Physiological Action.—When taken in full doses, ailanthus nauseates and purges; it also gives rise to vertigo, headache, pains in the back and limbs, and prostration, with numbness or tingling. Both respiration and pulse-rate are reduced; death results from arrest of respiration.

Therapy.—The fresh bark has been used in the treatment of tapeworm, in decoction (15.5 Gm. to 473 c.cm., or ℥iv-Oj) or the oleoresin (in 4 c.cm., or f℥j, doses). It has also been used in malignant scarlatina, in spasmodic disorders, and in dyspepsia. An infusion of the leaves has been employed in dysentery.

AIR.—A mixture of oxygen and nitrogen, with smaller quantities of carbon dioxide, argon, and watery vapor, together with accidental organic and inorganic constituents, composing the atmosphere, which we breathe. (For the effects of air, see section devoted to **Climatotherapy,** also **Pneumotherapy and Pneumatic Differentiation.** For Liquid Air, see section on **Heat and Cold as Therapeutic Agents.**)

AIROL. — This is a trade designation for bismuth-oxyiodogallate, which is a grayish-green, odorless, tasteless powder. It is insoluble in alcohol, water, etc. It has been employed as a surgical antiseptic dusting-powder or as an emulsion with glycerin (10 per cent.), or also as an ointment, as a substitute for iodoform. Airol has also been used internally as an intestinal astringent, in doses of 0.13 to 0.32 Gm. (or gr. ii-v) several times daily. In ophthalmic practice Bonivento had good results in forty cases of infectious, ulcerous keratitis, the remedy being lightly dusted upon the affected area after preliminary antiseptic cleansing. Its application is usually painless.

ALBARGIN.—A trade name for gelatose silver nitrate. (See **Argentum.**)

ALCOHOL (U. S. P.), **SPIRITUS RECTIFICATUS** (B. P.).—**Alcohol, Spirit of Wine** (C_2H_5OH).

Preparations.

Alcohol Dilutum (U. S. P.).—Diluted Alcohol (equal parts alcohol and water).
Spiritus Frumenti (U. S. P.).—Whisky (contains about 50 per cent. of alcohol).
Spiritus Myrciæ (U. S. P.).—Bay-rum. For external use.

Vinum Album (U. S. P.).—White Wine (10 to 12 per cent. alcohol).

Vinum Rubrum (U. S. P.).—Red Wine (10 to 12 per cent. alcohol).

Alcohol Absolutum (U. S. P., B. P.).—Absolute Alcohol (containing not more than 1 per cent., by weight, of water).

Spiritus Vini Gallici (U. S. P., B. P.).—Brandy (contains about 50 per cent. of alcohol).

Mistura Spiritus Vini Gallici (B. P.).—Mixture of Brandy (brandy, 113 c.cm.; cinnamon-water, 113 c.cm.; refined sugar, 14 Gm.; two yelks of eggs). Dose, 30 to 60 c.cm. (or f℥i-ij).

Vinum Aurantii (B. P.).—Orange-wine (contains 10 to 12 per cent. alcohol by volume).

Vinum Xericum (B. P.).—Sherry Wine (contains not less than 16 per cent. of alcohol by volume).

Not Official.

Spiritus Genevæ.—Gin (dilute alcohol flavored by juniper-berries).

Spiritus Jamaicensis.—Jamaica Rum (spirits from molasses).

Spiritus Odoratus.—*Eau-de-Cologne*, Cologne-water.

Alcohol is a liquid composed of 91 per cent., by weight (94.9 by volume), of ethyl-alcohol, and of 9 per cent., by weight (5.1 by volume), of water. Specific gravity, 0.820 at 59° F. It is a transparent, colorless, volatile, inflammable substance, with a characteristic, pungent, rather agreeable taste and odor. The British Pharmacopœia recognizes absolute alcohol and rectified spirits, the latter containing 90 per cent., by volume, of ethyl-hydroxide. **Proof spirit** contains 50 per cent. of absolute alcohol.

Pharmacology.—The hydrate of the hydrocarbon radical (C_2H_5) is ordinarily understood to be meant by the term alcohol, although many other alcohols are known to the chemist. Ethyl-alcohol, also, is the alcohol of brandy, whisky, wine, and various spirits and cordials. Its effects upon the organism are less toxic than those of other alcohols, such as amylic, methylic, or butylic. During distillation of grain, unless carefully managed, considerable amylic alcohol will pass over with the ethylic, especially if the process be continued too long. By keeping whisky stored for several years, the amylic alcohol becomes largely changed into various ethers, which impart a flavor or bouquet to the spirit. The United States Pharmacopœia, therefore, directs that grain-spirit (whisky) should be at least four years old, and the spirit from fermented grapes (brandy) at least four years old. Wine is made by fermentation without distillation. Red wine is a deep-red, alcoholic liquid, made by fermenting the juice of colored grapes in the presence of their skins; white wine is of a pale-amber or straw color, and is obtained by fermenting the unmodified juice of the grape, free from seeds, stems, and skins. Spiritus Genevæ (gin, or Hollands) is not official: it is obtained by adding juniper-berries to diluted alcohol. Rum, or molasses spirit (spiritus fuscus, or Jamaicencis), is made by distillation from sugar or molasses which has undergone alcoholic fermentation; it is about the same alcoholic strength as whisky.

Alcohol dissolves alkaloids, fatty and resinous substances, and is largely used as a menstruum in obtaining the active principles of drugs in an available form for administration. It is the basis of the U. S. P. spirits, tinctures, and elixirs; spirits being solutions of volatile substances in alcohol; tinctures, solutions of active principles of plants, generally obtained by maceration and percolation. An elixir is a cordial flavored with orange and syrup, generally used as a vehicle for other remedies. Malt liquors—ale, beer, porter, etc.—are produced by fermentation of malt and hops, and con-

tain nutritive material, together with a small proportion of diastase, which makes them useful in certain cases of weak digestion. They contain only from 6 to 10 per cent. of alcohol. Malt liquors can be taken by those who suffer from the cerebral effects of wine, but to some they are unpleasant in their effects upon the brain, owing to the oil of hops which they contain (Rossbach).

Absolutely-pure alcohol is rarely found, even in the laboratory of the chemist. Owing to its great affinity for water, it will in time abstract it from the air. Absolute alcohol, of the shops, usually contains about 2 per cent. of water. It is a colorless, pleasant-smelling liquid, with a sharp, warm taste. When added to water, heat is developed, and the mixture does not measure as much as the sum of its constituents, owing to combination. Besides its affinity for water and its power as a solvent, it has a coagulating action upon albumin, and is an antiferment when in solution containing at least 18 per cent. of alcohol.

Physiological Action.—Owing to volatility, it gives a cool sensation to the skin at first, but afterward, if evaporation be interfered with, it causes irritation and heat, and, if continued, produces inflammation. It also hardens the integument by abstracting water from it, coagulating some of its albuminoid constituents, and dissolving its fat. It has the same effect upon mucous membranes, thus enabling it to act as an astringent. It has some anæsthetic action, possibly by reducing the congestion by its cooling or constringent effects upon the smaller blood-vessels.

After alcohol, in the strength of ordinary spirits, is swallowed, in small quantity (15 to 60 c.cm., or f℥ss-ij), there is a sensation of heat in the epigastrium, which soon diffuses itself over the body. The experiments of Dr. Beaumont showed that small amounts increased the vascularity of the stomach and stimulated the flow of gastric secretions. Under favorable circumstances, therefore, alcohol increases the digestive power, causing an augmented gastric juice. If taken in large quantities, appetite is lost and nausea appears, and the digestive power is suspended. As a result of long-continued indulgence in alcohol, the stomach undergoes changes in its coats, new areolar tissue being formed, which, by its subsequent contraction, strangulates the gastric glands; hence, dyspepsia and gastric catarrh, with morning vomiting, are very common among drunkards. In addition to structural changes, alcohol, in excess, precipitates pepsin from the gastric juice, and thus increases digestive difficulties.

H. Wendelstadt,[1] of Bonn, as a result of some experiments made to determine the influence of alcohol on the respiration in man, found that there was much individual variation, but in 29 cases in which pure alcohol was ingested, 7 showed diminution of respiratory activity; but, when the alcohol was taken in the form of wine, only 2 showed such diminution, while the amount of increase in every case in which it occurred was greater. The increase was also more marked in cases of fatigue or debility. He therefore concludes that in debilitated states of the body, alcohol, especially in the form of wine having much aroma, is the best stimulant.

Dr. Glaser has recently studied the effect of alcohol upon the kidneys and urine. He finds that a moderate quantity of alcohol causes irritation of the kidneys and alters the solubility of the urinary salts, favoring the

[1] *Lancet*, Feb. 17, 1900.

deposit of oxalate of lime and uric acid. The influence does not extend beyond thirty-six hours, but the continued use of alcohol produces a cumulative effect. Dr. David Cerna, who has also investigated the action of alcohol, concludes that in large doses it enhances coagulation of the blood, while in toxic quantities it destroys the ozonizing power of that fluid and causes a separation of hæmoglobin from the corpuscles. Over-indulgence in alcohol has long been thought to impair the sexual power, and there seems reason to infer from certain experiments made by M. Bouin and M. C. Garnier[1] that it may actually cause decided degenerative changes in the testicles. Having induced chronic alcoholism in a number of white rats, in two of the animals they found atrophy of the testicles, with almost complete destruction of the epithelium of the seminiferous tubules.

Dubois noticed that certain plants exuded droplets of moisture over the surface when exposed to the influence of chloroform, ether, benzin, and alcohol. He considers the process an indication that the vapors penetrated the protoplasma of the plant-tissues and forced out the water, taking its place. Meyer[2] bases a theory in regard to the effect of narcotics in man on the observation of this phenomenon, suggesting that certain substances in the protoplasma of the cell,—the lecithin, etc.,—so important to the healthy functioning of the cell, are dissolved out of their normal proportions of solution and combination in respect to the other components of the cell,—the water, salts, albumin, etc.,—by the tension of solubility between them and chloroform, alcohol, and other narcotics, analogous to the effect of salt in the organism. If this theory is correct, then all chemical substances which dissolve fat and bodies resembling fat—lecithin, protagon, etc.—must produce a narcotizing effect on living protoplasma, and the effect would be most marked on the cells which contain the largest proportion of these substances: the nerve-cells. The effect would also depend on the mechanical affinity of the narcotics for the other constituents of the cells besides the fatty matters, especially the water, and also on its co-efficient of division in a mixture of water and fatty substances.

Upon the nervous system alcohol first has an exciting effect, followed by depression and coma. The arterioles are dilated, thus admitting more blood to the brain, and this is succeeded by diminution of mental activity, owing to the effects of the alcohol upon the ganglion-cells, weakening their action. A similar effect is seen on the spinal cord, usually occurring later than, but sometimes preceding, the brain symptoms. The reflex action of the cord is reduced and the power of co-ordination impaired, so that walking is by a staggering gait, and finally the knees will no longer support the body. This paralyzing effect is also seen in the sympathetic system, since the dilatation of certain vascular areas must be due to the loss of function of the vasomotor nerves. The action upon the centres in the medulla is seen in the lowered temperature, the slowing of the pulse after a preliminary acceleration, and the sighing respiration or stertor. Death is produced by respiratory paralysis and lowering of the bodily heat. From this it is seen that alcohol will not protect from cold, but will actually hasten the occurrence of death from cold. The experience of Arctic voyagers is to the effect that those persons endure the rigors of the winter best who abstain from alcohol. Dr. Parkes, in the Ashantee campaign, also found that the fatigue of march-

[1] *Presse Médicale*, Jan. 17, 1900.
[2] *Archiv f. Exp. Path. u. Pharmakologie*, xlii, 2 to 4.

ing in the tropics is borne better without the aid of a spirit ration, owing to the diminution of muscular and nervous energy and capacity for work, due to the physiological action of this agent. The only advantage derived from its use was to take away the feelings of fatigue after the men had come into camp, and thus enable them to eat. It is also useful, in the form of hot drink, to revive a person, who has been exposed to cold, after the exposure has ceased. Major Charles E. Woodruff, United States Army, believes that small quantities of alcohol are useful in the tropics, to counteract the stimulating effect of excessive sunlight.

As to the changes that alcohol undergoes in the body, Anstie states that a variable amount (4 to 15 c.cm., or f3i-iv) disappears, or is burnt up in the blood or the tissues; this quantity may be increased by habit. The excess is thrown off by the lungs, kidneys, bowels, and possibly by the skin.

Prof. W. O. Atwater, of Middletown, Conn., from experiments to determine the effects of moderate doses of alcohol, found: 1. That extremely little of the alcohol was given off unconsumed. 2. That in the oxidation all of the potential energy of the alcohol was transformed into heat or muscular energy. 3. That the alcohol protected the material of the body from consumption just as effectively as the corresponding amounts of sugar, starch, or fat. It is, however, to be borne in mind that the influence of the alcohol upon the circulatory and nervous functions is especially important, and that these matters did not come within the limits of Atwater's experiments.[1] The inference sought to be drawn from these experiments that alcohol is a safe and useful food is questioned by Woodbury and Egbert, who assert that alcohol at the best is useful only as a stimulant and excitant to the circulation and nervous systems during emergencies, and they quote authorities to prove that as a food its objections outweigh its alleged advantages.[2]

Toxicology.—The symptoms and treatment of acute poisoning by alcohol differ so much from those of the chronic form of alcoholism that each state must be separately considered:—

1. Acute poisoning by alcohol manifests itself by an exaggeration of the physiological action. The rapidity with which grave symptoms appear is in proportion to the quantity of alcohol taken, its form, and, to some extent, its temperature, as hot drinks more rapidly intoxicate than cold. Where a large quantity is taken at once, as when a whole bottle of whisky is drunk on a wager, or a comparatively large quantity administered to a child, the stage of excitement is too brief to be noticed, and the patient falls at once into a stupor, which may be followed by coma or fatal convulsions. Where the administration is spread out over a longer period, drunkenness comes on progressively, but ends in unconsciousness and insensibility, and the patient is said to be dead-drunk, because of his complete helplessness. Since alcohol increases the blood-supply of the brain (and especially since drunken men are apt to fall heavily and strike their heads), the state of alcoholic coma may often be accompanied by meningeal hæmorrhage or apoplexy. Intoxicated persons should never be allowed to sleep off their drunkenness, but should be treated as if they were poisoned, as—in fact—they are. The treatment consists simply in evacuating the stomach with emetics (mustard, etc.,) or the pump, and administering ammonia, either

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[1] *Bulletin No. 69, of the U. S. Department of Agriculture*, Nov., 1899.
[2] *Journal of the American Medical Association*, March 31, 1900.

the aromatic spirit or the carbonate, both by the mouth and by inhalation. The spirit of Mindererus likewise fulfills the same purpose. Digitalis may be given hypodermically; or, if the patient is noisy, morphine and atropine in moderate doses. It is said that 30 or 60 c.cm. (or f℥i-ij) of cider-vinegar has a sobering effect; and after emptying the stomach with the stomach-pump it is well to introduce a pint of warm coffee,—it should not be *hot* coffee, for fear of injuring the stomach during unconsciousness. Artificial respiration and electricity may be required to keep up the breathing and prevent the undue accumulation of carbonic acid in the blood. Cold affusions should be used with care, on account of the lowering of temperature by the alcohol; but heat and sinapisms are of great utility. Apoplexy, or cerebral hæmorrhage, may be suspected when there is marked deviation of the eyes or unequal dilatation of the pupils, especially if there is co-existing paralysis of one side of the face or of the arm or leg. In such a case the question of surgical interference would come up, to decide upon the presence of fracture of the skull or meningeal hæmorrhage and the appropriate treatment therefor.

2. Chronic poisoning by alcohol may be shown by the changes taking place in the stomach, liver, and kidneys; increase of fibrous or areolar tissue, followed by contraction and destruction of the characteristic secreting cells, and fatty infiltration; or, in other words, the type of cirrhosis due to the long-continued action of alcohol upon the tissues. Gastric catarrh, indigestion due to deficient action of the liver, and albuminuria from contracted and crippled kidneys are commonly met with in old alcoholic subjects. Chronic laryngitis and bronchitis, also chronic catarrhal pneumonia and fibroid phthisis, are also frequent in such subjects. The effects, however, are most marked upon the nervous system. Dr. Wilks has reported cases of paraplegia and numbness. Anæsthesia and violent shooting pains have followed the long-continued and excessive use of alcohol. A case of vasomotor disturbance due to the habitual use of alcohol has been recorded by Dr. G. Kaempfer. A man, who had been an excessive drinker, was attacked, within half an hour after taking any alcoholic fluid, by an eruption on the skin consisting of patches of erythema of variable size and color.

The damage produced by the habitual consumption of alcohol is not confined to the drunkard, but is transmitted to his children. It has been abundantly shown that the offspring of alcoholics are degenerates, afflicted with morbid craving for drink and subject to epilepsy, idiocy, chorea, hysteria, and physical defects. When alcoholic poisoning is mentioned, we generally understand it to mean delirium tremens or mania a potu. These are not identical; the latter is, to all intents and purposes, an acute attack of mania caused or incited by alcoholic excess. Delirium tremens, on the contrary, is a milder form of delirium, due partly to the action of the alcohol upon the brain, but also very largely to anæmia of the great centres. In the former the patient is violent, and requires several men to control him; but once controlled, and the proper medicines given (potassium bromide, hyoscine hydrobromate, or chloroform inhalations), the patient, after a period of sleep, usually rapidly recovers. In delirium tremens the symptoms are mainly those of anæmia of the brain; it is apt to occur after a bout of drinking lasting several days, during which very little food is eaten or is rejected by vomiting from the excess of alcohol. Here the patient has a quiet delirium, and has hallucinations of sight and hearing, which

in many cases may not greatly annoy him, but, on the other hand, his visions may be horrifying and very distressing. These patients are best treated with digitalis, and amyl nitrite may be cautiously given by inhalation, or nitroglycerin by the mouth. Nourishment must be given in a form readily assimilated and at short intervals, hot broths, well seasoned, being the most acceptable to the stomach. If, as is usually the case, the patient has been a steady drinker for a long time, alcohol should not be entirely withheld from him, but given in combination with food. In such subjects the blood-vessels are generally the subject of atheromatous changes, and the heart requires its accustomed stimulation in order to carry on the circulation. If the patient cannot sleep, he may be helped by sodium bromide and chloral (aa 0.65 Gm., or gr. x), by hop-tea with capsicum, or the ammoniated tincture of valerian. For the debility and tremor, nux vomica has proved very useful in comparatively large doses of the tincture (2 c.cm., or f℥ss, or more). Hypodermic injections of strychnine nitrate are also useful. After death from chronic alcoholism the organism shows changes in every part, which Bartholow summed up in two words, "fibrosis and steatosis."

By inhaling the vapor of alcohol, complete anæsthesia may be produced, and the different degrees of intoxication up to insensibility. In such cases the stomach need not be emptied, but artificial respiration in the open air, or the inhalation of oxygen will soon restore the patient to consciousness. This may be hastened by a stimulating enema.

Absinthism, a form of alcoholic poisoning attended by epilepsy, following indulgence in absinthe, has been already discussed.

Methylic spirit, or wood-alcohol, on account of its cheapness, is sometimes used to adulterate whisky, or as a substitute for it, and is largely employed in the arts. Under the name of Columbia spirits it has an extensive sale. It is much more toxic than ethyl-alcohol, and has the peculiar property of causing optic neuritis and blindness.

Therapy.—Alcohol may be used as an evaporating lotion in cases of local inflammation, or of bruise or sprain. Diluted alcohol (90 c.cm., or f℥iij) with lead-water (30 c.cm., or f℥j) and morphine acetate (0.65 Gm., or gr. x), applied upon a single layer of cloth or absorbent cotton and allowed to evaporate, forms an excellent lotion to keep down inflammation, and in point of cleanliness is much better than the old lead-water and laudanum. Absolute alcohol is used as an astringent application to exuberant granulations (polypi) in the ear, and also applied as just directed to control acute inflammation of cellular tissue, and in erysipelas. Ordinary alcohol is a good application to prevent bed-sores, and for this purpose it is customary to add a little alum (4 Gm. to 473 c.cm., or ʒi-Oj). Hot applications of alcohol relieve pain, and in facial neuralgia, cold in the face, or toothache, the employment of a small flannel bag containing hops and dipped in hot whisky will generally afford marked relief. In some skin diseases, as ulcers, loss of hair, frost-bite, excessive secretion of sweat or oil, fetid sweating, freckles, and vegetable parasitic affections, concentrated alcoholic preparations may be used. Some useful formulæ are here added:—

℞ Alcoholis,
Glyceriti boroglycerini ..... aa 60| c.cm. or f℥ij.

M. Sig.: Apply freely in excessive or fetid sweating, and in vegetable parasitic diseases of the skin.

When glycerin does not agree, we may prescribe:—

℞ Alcoholis ..... 60| c.cm. or f℥ij.
Cocainæ hydrochloridi ..... |32 Gm. or gr. v.
Acidi borici ..... 4| Gm. or ʒj.
M. Sig.: Use with old muslin or cotton in frost-bite, oily secretion, freckles, and other pigmentary deposits.

℞ Spt. vini gallici ....120| c.cm. or f℥iv.
Tinct. nucis vomicæ.....15| c.cm or f℥ss.
Tinct. capsici ..... 7|50 c.cm. or f℥ij.
M. Sig.: Apply on the scalp for loss of hair, with friction once daily.

Leloir recommends the local application of alcohol or an alcoholic solution as an effective abortive measure in herpes. The same treatment will relieve the pain of herpes zoster.

L. Neustadl[1] reports a case confirmatory of Biers and Salzwedel's experience as to the great value of alcohol dressings in tubercular lesions. In the case referred to there were tendo vaginitis and osteitis tuberculosa of the left hand. After the daily applications of a compress wet with alcohol for six weeks, it was completely cured, although it had been pronounced a proper case for amputation previous to the treatment. Angerer has also reported 7 cases of local tuberculosis treated by alcohol, 3 of which were cured and 4 remarkably improved.

Its antiseptic virtues and the astringency which it possesses in consequence of its power of coagulating albumin renders alcohol, when properly diluted, an excellent gargle in pharyngitis, stomatitis, scurvy, and salivation. It is also useful to apply an alcoholic lotion to the nipples of nursing women, in order to prevent the formation of fissures. Alcohol possesses considerable value as an hæmostatic, and may be utilized in cases where capillary oozing occurs, the following prescription being very valuable:—

℞ Alcoholis,
Liq. saponis,
Fluidext. hamamelidis ..... aa 30| c.cm. or f℥j.
M. Sig.: Employ as a styptic in local hæmorrhage.

To the action upon the digestive organs and the stimulating effect upon the nervous system and the circulation are to be ascribed the usefulness in the treatment of disease of alcohol judiciously given It is not used in sickness to reduce temperature, although it accomplishes this in health; nor is it given as a narcotic, although its sedative action may not be undesired. In almost all cases it is intended to act as a restorative, and, therefore, its administration must be kept well within physiological limits. In some cases, especially in typhoid fever, unfortunate results have followed its use with too free a hand. In most cases of fever, from 60 to 120 c.cm. (or f℥ii-iv) of whisky daily is amply sufficient for an adult, and more than this may do harm. It is judicious, however, to make allowance for the patient's previous habits. One accustomed to the daily use of alcoholic beverages will, generally speaking, require proportionately larger doses than an abstainer, when attacked by any severe disease.

In phthisis a tolerance seems to exist, and patients can take relatively large quantities without showing symptoms of intoxication. The late Austin

[1] *Prager medicinische Wochenschrift*, Feb. 15, 1900.

Flint reported the case of a young lady who took a pint of whisky daily for nearly two years, for pulmonary phthisis, and was finally cured. In the course of a disease, when the powers of life are succumbing, the first sound of the heart is weak; the pulse feeble, soft, and irregular, but generally rapid; when syncope or delirium threatens, alcohol should be given, endeavoring to combine it with food, such as broth, milk, gruel, etc. The period at which these symptoms generally appear is, in typhus fever, about the end of the first week; in typhoid, at the end of the second week; in small-pox, when the secondary fever commences. The excellent practical rules formulated by Dr. Armstrong for the use of alcohol in fever may be confidently followed. Alcohol is beneficial when the dry tongue moistens under its use, the rapid pulse becomes more slow, the skin less parched, and the respiration more tranquil, and, it might be added, where it suits the patient. If opposite results follow, the remedy should be suspended. To the above rules, Ringer adds that alcohol does good when it produces sleep and quells delirium. In measles, when the eruption turns dark or hæmorrhagic, alcohol is best given in as large doses as will be borne, and at short intervals, as pointed out by Dr. John M. Keating. In acute inflammations, as in pneumonia, when the heart begins to fail and symptoms of debility appear, alcohol can usually be given with marked benefit. In hypostatic congestion of the lungs, typhoid pneumonia, or the pneumonia of the aged, alcoholic stimulation is particularly indicated. Diphtheria, phlegmonous erysipelas, and tuberculosis of bones, joints, or glands are affections in which stimulation is demanded. The stronger alcoholic beverages—such as wine, whisky, or brandy—are valuable in old age, when digestion is weak and insomnia marked. Hot spirits and water, cautiously administered, is useful as a restorative in the condition of shock the result of injury. During convalescence from fevers, when the structures of the heart and stomach have been altered by the fever process and digestion is weak, it is often found that malt liquor in some form increases appetite and digestion, improves nutrition, and enables the patient to sleep better at night. In the same way, persons who follow sedentary occupations, and whose bodies are insufficiently nourished, often find much benefit from the use of alcohol in moderate quantities, given just before or after or taken with their meals. Its antiseptic powers are useful in infectious dyspepsia, where digestion is stopped by the growth of micro-organisms, which set up excessive fermentation in the stomach and intestinal canal. Its acknowledged value in the zymotic diseases, and pre-eminently in diphtheria, is partly due to its antiseptic action in the alimentary tract. In a similar manner, in cholera epidemics, alcohol has decided prophylactic effects, and this is not controverted by the fact that persons weakened by debauches and alcoholism are most liable to perish from the disease. In cholera infantum, also, brandy exerts an excellent influence; and, indeed, in many bowel disorders among adults (which are often connected with the growth of micro-organisms) alcohol in the form of brandy or red wine (port or Burgundy) is of great assistance in the treatment. When flatulent colic or neuralgic pains occur in the abdomen, cloths wet with hot whisky externally, and some hot toddy internally, give prompt relief; in infants, gin and hot water is a remedy often used for colic by old nurses.

Forms of Alcohol.—In order to estimate the effects of different forms of alcoholic liquors, the following comparative strength should be remembered:—

Brandy, whisky, rum, gin, cordials	30 to 50	per cent.	of	absolute	alcohol.
Spanish and Italian sweet wines	13 to 17	"	"	"	"
Hock and claret	8 to 11	"	"	"	"
Ale or porter	4 to 6	"	"	"	"
Stout or beer	4 to 5	"	"	"	"
Koumiss	1 to 3	"	"	"	"

Champagne contains from 8 to 10 per cent., but the presence of the carbonic-acid gas makes it more "heady"; that is to say, the cerebral stimulation is produced more quickly, and with a smaller quantity of alcohol than by the still wines, and the after-effects in the way of headache or cerebral congestion are less apt to occur. Moreover, the carbonic acid acts as a sedative to the stomach, thus making champagne especially serviceable where the stomach is irritable, and where prompt stimulation is required, as in seasickness or in yellow fever. Where the expense is an insuperable objection, a good substitute may be made extemporaneously by the addition of carbonic-acid water or koumiss to wine or brandy.

Special Applications.—As an antidote in snake-bite, alcohol enjoys an extensive reputation, which has not much scientific foundation. The liquor should be given only, a wineglassful or so at a time, repeated at intervals, but should not be given in excessive quantities on account of the danger of fatal alcoholic coma. A ligature should be thrown around the limb or member bitten, if possible, and the part cut out or cauterized; if a finger, it might be safer to amputate it. If not, the ligature should after awhile be loosened gradually, and immediately tightened upon the reappearance of the symptoms. In this way the system will be able to throw off the poison; whereas, if the whole quantity were to be introduced at once, it would be overwhelmed. The alcohol here acts, not as an antidote, but as a cardio-vascular stimulant to keep up the circulation until the poison is eliminated.

In septic poisoning—septicæmia, sapræmia, dissecting wounds, etc.—alcohol is considered to have an antidotal effect, and, with quinine, constitutes the great reliance for overcoming the tendency to a fatal result and keeping up the strength. Alcohol is, in some measure, antidotal to the poison of the bacillus tuberculosis, and it is to this action that its unquestionable value in prolonging life in phthisis is due.

Phelps and Powell[1] claim that alcohol is the best antidote for carbolic-acid poisoning. Phelps declares it a safe and sure local application to prevent the escharotic action of the latter upon the skin and mucous membranes. Several instances have been reported in which a fatal dose of the acid had been taken, but, owing to prompt use of whisky or brandy, the patient recovered. (See **Phenol.**)

Alcohol should not, as the rule, be given in liver disease, nor in nephritis. In gout the sweet wines and malt liquors are inadmissible, but, if a stimulant be required, whisky may be used cautiously, on account of the tendency to kidney disease. Malt liquors and sweet wines are injurious in diabetes, but dry wine, whisky, and brandy sometimes answer a useful purpose in that disease by promoting nutrition without increasing the loss of sugar. During the course of a gonorrhœa or urethritis, it is customary to forbid the use of alcohol in any form. It should not be used in hypertrophy, with overaction of the heart.

For the relief of cancer of the breast, Hasse, in 1873 (at a meeting of

[1] *Merck's Archives*, Dec., 1899.

German Physicians' and Naturalists' Association), presented a communication advocating injection of alcohol. The subject of the treatment of cancer by interstitial injections of alcohol has since been reviewed editorially by Dr. C. E. de M. Sajous.[1] Dr. Edwin J. Kuh has reported a case of primary cancer of the naso-pharynx cured by injections of alcohol,[2] but subsequently reports several failures of the treatment.[3]

ALETRIS. — Star-grass, Blazing-star, Mealy-starwort, Colic-root. Aletris farinosa (Liliaceæ) is an indigenous plant, the leaves of which spread upon the ground in the form of a star. The rhizome contains starch and a bitter principle, but appears to be free from tannin. The virtues of the root are extracted by alcohol. In small doses aletris is a bitter tonic; it increases the appetite, loosens the bowels, and promotes the secretion of urine. In larger quantities it acts as a cathartic and emetic. Aletris has been used in colic, chronic rheumatism, and dropsy. It is said to be serviceable, likewise, in dysmenorrhœa. The dose of the powder is 0.65 Gm. (or gr. x). An infusion (1-16) is given in tablespoonful doses. The National Formulary contains a fluid extract.

ALLIUM.—Garlic.

Preparation.

Syrupus Allii.—The syrup of garlic contains garlic (20 per cent.), with diluted acetic acid, and sugar. Dose, 0.60 to 4 c.cm. (or *m*x-f3j).

Pharmacology.—Garlic is the bulb of the Allium sativum (Liliaceæ), a native of Asia and Egypt, but now naturalized in Europe and America, and resembles the onion and leek in its chemical characters. Its active principle is a volatile, oily substance (0.25 per cent.). Garlic is more active than the others, owing to possessing a larger proportion of the active principle. The bulbs may be kept unchanged for years by placing them in large glass bottles containing a small amount of alcohol and securely closing the bottles by stoppers of glass or cork, as proposed by Mr. A. P. Sharp (Proc. A. P. A., 1864). The pharmacopœia directs that garlic should be used without being dried.

Physiological Action and Therapy.—Garlic is antiseptic, but its effects are chiefly those of a stimulating expectorant. While its antiseptic properties have been tried in phthisis without successful results, it is useful as an expectorant in chronic bronchitis, or in suffocative catarrh (capillary bronchitis of infants). Here it may also be made one of the ingredients of poultices to be applied to the chest, or the oil may be used externally, but the offensive odor of garlic will in most families be a bar to its use. A garlic poultice may also be successfully employed in infantile convulsions, and relieves the pain of gastro-enteritis. The syrup is a good addition to cough mixtures, but cannot be used in conjunction with alkalies, such as ammonium carbonate or the bromides, on account of its containing free acetic acid. The syrup of garlic can be administered thus with service in the treatment of bronchitis, especially of children:—

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[1] *Monthly Cyclopædia of Practical Medicine*, Jan., 1898.
[2] *Medical Record*, April 17, 1897.
[3] *Philadelphia Medical Journal*, May 28, 1898.

℞ Syrup. allii ..... 60| c.cm. or f℥ij.
Spt. æther. nitrosi,
Glycerini ..... aa 30| c.cm. or f℥j.
M. Sig.: From one to two teaspoonfuls in water every hour or two.

℞ Syrup. allii ..... 90| c.cm. or f℥iij.
Syrup. picis liquidæ ..... 60| c.cm. or f℥ij.
M. Sig.: A teaspoonful or two in water every two or three hours.

The juice of garlic in the dose of 2 to 5 drops has been given for the relief of nervous vomiting.

Garlic, like the onion, has antiscorbutic effects, and is a stimulant carminative. Dose, 2 Gm. (or gr. xxx); best given as a syrup. It is destructive to lumbricoid or round worms. It is also efficient against ascarides when administered by the rectum. Garlic is a domestic remedy in whooping-cough, and a garlic poultice applied to the perineum is said to relieve strangury.

Allyl-tribromide.—This compound, otherwise known as tribromhydrin, closely related to the oil of garlic, is a colorless or faintly-yellowish fluid, which has a specific gravity of 2.43, solidifies at 50° F., and boils at 422° F. Allyl-tribromide dissolves in ether, and in 5-drop doses, inclosed in capsules, has been given with advantage in various spasmodic affections, as hysteria, asthma, whooping-cough, infantile convulsions, and angina pectoris.

ALLIUM CEPA.—The onion (Liliaceæ) is cultivated everywhere, and the bulb is commonly used as a food. Onions are also largely used in domestic practice as a cataplasm for "earache" or for acute bronchitis; also added to sugar and water and given as a cough-syrup. Parkes ("Practical Hygiene") states that "on account of its volatile oils the onion tribe is largely used, and is a capital condiment, and has an effect as an antiscorbutic." The oil appears to be identical with that derived from garlic, $(C_3H_5)_2S$. Onions contain phosphoric acid, citrate of lime, mucilage, and sugar, in addition to the allyl sulphide.

According to the careful studies of Dr. Pilacki, the consumption of onions causes a decrease of the assimilation and metabolism of nitrogenous material. The assimilation exceeds the loss of nitrogen. The urine is generally increased. The diminished assimilation may be due to the injurious effect of large quantities of onion upon the gastric juice and digestion. Dr. Popoff has shown that onions neutralize the acid of the gastric juice. In a small quantity, however, onions promote digestion. Onions, and especially garlic, produce a decided augmentation of secretion of bile. In Siberia great dependence is placed on the onion as a prophylactic against scurvy.

Dr. Whitla points out that, owing to the large proportion of sulphur which it contains, the Spanish onion may be satisfactorily employed in those cases of skin disease in which it is desirable to administer sulphur. The action of the volatile constituents enhances that of the sulphur. Boiled Spanish onion, eaten freely at bed-time, is an excellent laxative. The author mentioned values the onion particularly in chronic catarrh of the larger respiratory tubes. According to George Covert, sweet milk removes the odor of onion from the breath.

The raw sliced onion can be used as a counter-irritant; its volatile constituents are especially irritating to the conjunctiva.

ALNUS.—Alder-bark. The bark of the American alder or tag-alder, Alnus serrulata (Betulaceæ), contains tannic acid, a resin, and an oil. It is used for its astringent effects, chiefly in the form of fluid extract or infusion (diluted freely), as a mouth-wash for spongy gums, a gargle for sore throat, an injection in leucorrhœa, and for applications to ulcers. Internally, it has been given in diarrhœa and hæmaturia. It is reported to have alterative effects, and has been used successfully in scrofula, syphilis, and some cutaneous diseases. The dose of fluid extract is 0.6 to 2.5 c.cm. (or *m*x-xl). **Alnuin**, an alcoholic extract, composed principally of the resin, has been employed internally in doses of 0.065 to 0.20 Gm. (or gr. i-iij).

ALOE (U. S. P., B. P.).—**Aloes.**

ALOE PURIFICATA (U. S. P.).—**Purified Aloes:** a Strained Alcoholic Extract.

Dose, 0.065 to 1.30 Gm. (or gr. i-xx).

U. S. P. Preparations.

Aloinum.—Aloin. Dose, 0.006 to 0.13 Gm. (or gr. $^1/_{10}$-ij).

Extractum Aloes.—Extract of Aloes. Dose, 0.03 to 0.32 Gm. (or gr. ss-v).

Pilulæ Aloes.—Pills of Aloes. Dose, 1 to 5 pills.

Pilulæ Aloes et Ferri.—Pills of Aloes and Iron. Dose, 1 to 5 pills.

Pilulæ Aloes et Mastiches.—Pills of Aloes and Mastic. Dose, 1 to 5 pills.

Pilulæ Aloes et Myrrhæ.—Pills of Aloes and Myrrh. Dose, 1 to 5 pills.

Pilulæ Laxativæ Compositæ.—Compound Laxative Pills (aloin, gr. $^1/_5$; belladonna ext., gr. $^1/_8$; strychnine, gr. $^1/_{13}$; ipecac, gr. $^1/_{16}$; glycyrrhiza, gr. $^3/_4$, each pill).

Pilulæ Rhei Compositæ.—Compound Pills of Rhubarb. Dose, 1 to 5 pills.

Tinctura Aloes.—Tincture of Aloes (10 per cent.). Dose, 7.50 c.cm. (or 3ij).

Tinctura Aloes et Myrrhæ.—Tincture of Aloes and Myrrh (of each, 10 per cent.). Dose, 2 to 7.50 c.cm. (or f3ss-ij).

B. P. Preparations.

Aloinum.—Aloin. Dose, 0.03 to 0.13 Gm. (or gr. ss-ij).

Extractum Aloes Barbadensis.—Extract of Barbadoes Aloes. Dose, 0.065 to 0.25 Gm. (or gr. i-iv).

Pilula Aloes Barbadensis.—Pill of Barbadoes Aloes. Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Pilula Aloes Socotrinæ.—Pill of Socotrine Aloes. Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Pilula Aloes et Asafœtidæ.—Pill of Aloes and Asafetida. Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Pilula Aloes et Ferri.—Pill of Aloes and Iron. Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Pilula Aloes et Myrrhæ.—Pill of Aloes and Myrrh. Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Tinctura Aloes.—Tincture of Aloes. Dose, 2 to 4 c.cm. (or f3ss-j) for repeated administration; for single administration, 6 to 7.5 c.cm. (or f3iss-ij).

Decoctum Aloes Compositum (B. P.), or Baume de Vie, contains about 0.25 Gm. (or gr. iv) aloes to 30 c.cm. (or f$\overline{3}$j), with cardamom, licorice, saffron, and myrrh. Dose, 15 to 60 c.cm. (or f$\overline{3}$ss-ij).

Aloes also enters into compound extract of colocynth and compound tincture of benzoin (U. S. P., B. P.); compound pill of colocynth (B.P.); compound pill of hyoscyamus (B. P.); and compound pill of gamboge (B. P.).

Pharmacology.—Aloe is the inspissated juice of the leaves of Aloe vera, Aloe chinensis, and Aloe Perryi (Liliaceæ). Owing to the fact that aloe frequently contains foreign matters, the United States Pharmacopœia directs that, for making preparations, purified aloes only should be used (obtained by dissolving commercial aloes in alcohol, passing the solution through a strainer, and allowing the alcohol to evaporate). This occurs in dark masses of a yellowish-brown color, the fracture presenting a liver-like appearance (hence sometimes called hepatic aloes). It has a very bitter taste, is soluble in alcohol, less soluble in water (unless boiling), and contains **Aloin emodin,** a trace of volatile oil, and a resin. Barbadoes aloes and Cape aloes each contains a special variety of aloin, known as barbaloin and nataloin), which may be distinguished by tests from that present in Socatrine aloes, which is called **socaloin.** They are now equally official.

Aloinum (U. S. P., B. P.), or **Aloin,** is a neutral principle obtained from several varieties of aloes, chiefly Barbadoes aloes (yielding barbaloin) and Socotra or Zanzibar aloes (yielding socaloin), differing more or less in chemical composition and physical properties according to the source from which it is derived. It is a yellowish-white, or brownish crystalline substance, soluble in hot water and alcohol, sparingly soluble in ether, chloroform, and benzol. It is of neutral reaction, destitute of odor, and its taste, which is sweetish at first, subsequently becomes very bitter.

Physiological Action.—The principal effect of aloes is that of a slowly-acting purgative, principally affecting the large intestine. It increases the peristaltic movements without producing excess of secretion; so that the fæces are formed and only slightly softened. It is a true cholagogue, increasing the secretion of biliary salts, and renders the bile more watery when given in large doses. As it sometimes gripes, it is best to combine some carminative with it. It may cause irritation of the bladder, diminution of urine, and albuminuria from renal congestion. It also has emmenagogic properties. Following large doses, the uterus and appendages are more or less in a state of congestion and hæmorrhoids are apt to be irritated. If there has been an overdose and these symptoms are aggravated, it would be sufficient to give large draughts of demulcents, and an anodyne in the form of an opium suppository. It is stated that such phenomena do not follow the administration of aloin, which requires only about one-third or one-half the dose in order to produce the physiological effects of aloes.

The chemical and physiological investigations of Professor Meyer seem to indicate that aloin itself is not an active purgative, but that it becomes gradually decomposed in the intestine into **emodin,** or **trioxymethylanthraquinone.** It is thought that this may account for the slowness of its action.

Powdered aloes, dusted upon an abraded or blistered surface, may be absorbed and exert a purgative effect. Aloin has been detected in the urine.

Therapy.—Aloes, or aloin, is a slowly-acting purgative, and, therefore, should generally be administered at bed-time; in this way it operates during sleep, and griping is avoided. For the same purpose it is well to combine it with a carminative, as in the compound decoction, or the compound rhubarb pill, which is a useful purgative for an ordinary attack of constipation. The following are likewise excellent formulæ to use in the same class of cases:—

℞ Vini aloes,
Fluidext. rhamni purshianæ.....aa 22| c.cm. or f3vj.
Elix. aromatic. .....q. s. ad 180| c.cm. or f3vj.
M. Sig.: A tablespoonful morning and evening.

℞ Aloes purificatæ..... 12| Gm. or 3iij.
Pulv. glycyrrhizæ comp. ..... 124| Gm. or 3iv.
M. Sig.: From one-half to three teaspoonfuls in water or milk, early in the morning or on retiring.

Kohlstock has experimented in the clinic of Professor Senator, of Berlin, with aloin and other cathartics applied locally to the rectum. The aloin was dissolved in a small quantity of glycerin and subsequently in formamide, 1 Gm. (or gr. xv) of the former to 10 Gm. (or gr. cl) of the latter. A dose representing, of the aloin, 0.38 to 0.50 Gm. (or gr. vi-viij), was found efficient, in all mild cases of constipation.

The pill form is also useful for the expulsion of ascarides, which are apt to lodge in the cæcum. With this may be combined injections of aloes in solution (4 Gm. to 473 c.cm., or 3i-Oj) and irrigation of the bowel. For the latter purpose, in young children, a soft catheter can be inserted beyond the sigmoid flexure of the colon. In anæmia affecting young girls (chlorosis) Sir Andrew Clarke claimed that constipation has much to do with its causation; he called it fæcal intoxication. Here aloes, in combination with iron, is of much service:—

℞ Aloes purificatæ ..... 8| Gm. or 3ij.
Massæ ferri carbonatis ..... 2|60 Gm. or gr. xl.
Pulv. aromatici ..... 1|30 Gm. or gr. xx.
M. et ft. pil. no. xx.
Sig.: Take one or two at bed-hour.

Sir Andrew Clarke's pill is likewise valuable:—

℞ Aloin.,
Ferri sulph. exsic.,
Ext. belladonnæ alc. (B. P.),
Ext. nucis vom.,
Pulv. ipecac.,
Pulv. myrrh,
Saponis ..... aa |03 Gm. or gr. ss.
M. et ft. pil. no. j.
Sig.: One pill one hour before last meal, should the bowels not act during the day.

Ipecac is omitted if there is any cardiac weakness.

In cases of hysteria, with anæmia and constipation, the pills of aloes, with asafetida, may be given (3 to 6 daily). These have also a carminative effect. An atonic condition of the muscular coat of the large intestine may allow its contents to accumulate, to press upon the common bile-duct, and obstruct the passage of the biliary secretion into the upper bowel. This condition and the jaundice which is its result are relieved by the administration of aloes, with which belladonna and strychnine, or hyoscyamus and ipecacuanha, may be very usefully combined, in such formulæ as the following:—

℞ Aloes purificatæ ..... 2| Gm. or 3ss.
Ext. belladonna folior..... |065 Gm. or gr. j.
Strychninæ sulphatis ..... |03 Gm. or gr. ss.
M. et ft. pil. no. xij.
Sig.: A pill three times a day.

℞ Aloini		065 Gm. or gr. j.
Ext. hyoscyami		65 Gm. or gr. x.
Ext. nucis vomicæ		065 Gm. or gr. j.
Pulv. ipecacuanhæ		13 Gm. or gr. ij.

M. et ft. pil. no. x.
Sig.: A pill three times a day.

Aloes is an excellent emmenagogue; given for several days before the expected period, it is generally successful, especially when employed thus:—

℞ Aloini		13 Gm. or gr. ij.
Mass. ferri carb.	2	40 Gm. or gr. xxxvj.
Apiol.	4	c.cm. or f3j.

M. et ft. capsulæ no. xij.
Sig.: A capsule morning and evening for five or six days before the menstrual period.

In scanty menstruation, depending upon anæmia, the chalybeates should also be pushed, preferably using the preparations of iron which are not constipating, such as the dialyzed iron, or the carbonate, or pyrophosphate, rather than the sulphate, which is contained in the official pill. When intestinal indigestion is caused by deficient secretion of bile, aloes is of special value, and enjoys a reputation as an ingredient in "dinner-pills" of many kinds. Where the mental symptoms of dyspepsia—drowsiness, depression of spirits, or melancholia—are marked, the use of a good aloetic pill immediately after dinner is often effective.

In cases where there are hæmorrhoids, the aloes sometimes irritates them ; under such circumstances the proper course to pursue would not be to neglect such a valuable remedy, but to operate surgically upon the piles and remove them. The passive turgescence of the inferior hæmorrhoidal vessels, however, is not infrequently relieved by the use of aloes. Whitla speaks of having obtained surprising results in obstinate diarrhœa in children or adults from the administration of a few 30- to 60-c.cm. (or f℥i-ij) doses of the compound decoction of aloes (B. P.). We may prescribe the following, for an adult with obstinate diarrhœa:—

℞ Aloini		13 Gm. or gr. ij.
Sulphuris subl.	6	50 Gm. or gr. c.
Ext. belladonna folior.		13 Gm. or gr. ij.

M. et ft. capsulæ no. xx.
Sig.: A capsule three times a day.

In small doses aloes acts as an hepatic and intestinal tonic. Where diarrhœa is maintained by the action of germs of fermentation, the increased flow of bile exerts an antiseptic effect and the diarrhœa may be checked after a preliminary purge; although the rule is that, where diarrhœa is due to irritation from abnormal condition of the contents, the cause of disturbance should be removed by a more prompt cathartic, such as sulphate of magnesia (or the citrate) or by an antiseptic purgative like calomel or blue mass. Aloetic purgatives should be used with care during pregnancy and lactation. The milk of women taking aloes will purge babes whom they suckle. Aloes may be used as a derivative in cerebral disorders.

A glycerole of aloes is prepared by evaporating the tincture and adding glycerin. This mixture may be applied to fissures, abrasions, and ulcers. The bitter taste of aloes is sometimes utilized by applying a solution to the finger-ends of children in order to break them of the habit of biting their

nails or sucking their thumbs, or to the nipple when it is desired to wean an infant, which is unnecessary cruelty. The compound tincture of benzoin contains 2 per cent. of aloes. This fact should be borne in mind when treating cracked nipples with this preparation, as the infant may be weaned too early.

ALPHOZONE.—Disuccinyl Peroxide, or Succinic Dioxide ($(COOH.CH_2CH_2CO)_2O_2$). A newly-introduced chemical compound, with powerful germicide properties, discovered by Prof. A. M. Clover, of the University of Michigan. It is a white, crystalline powder, soluble in about 60 parts of water, odorless, and with slight bitter taste. In combination with water it undergoes hydrolysis, and forms succinic peracid. It is claimed to be equal to mercuric bichloride as a germicide. It is used in $^1/_{100}$ to $^1/_{300}$ solution as an external application. It has also been used internally, both as a gargle and to be swallowed, in typhoid and other infectious diseases. Dose, 0.13 Gm. (or gr. ij), in half a glassful of water.

ALTHÆA (U. S. P.).—**Marshmallow.**

Preparation.

Syrupus Althææ.—Syrup of Althæa (5 per cent.).

Pharmacology.—The dried root of Althæa officinalis (Malvaceæ), collected from plants of second year's growth, and deprived of its periderm. It contains a mucilaginous principle, with about 2 per cent. of **asparagin**, but no tannin. Althæa is a constituent in massa hydrargyri (blue mass) and phosphorus pills.

Therapy.—The powdered root treated with hot water may be used as a poultice. It is slightly diuretic, on account of the asparagin, which would make it of service in children's diseases in the form of a fresh infusion, especially in Bright's disease. The confections are useful in sore throat, in scarlatina, and diphtheria. The syrup is an agreeable addition to cough-mixtures. Dose, indefinite. Althæa combined with benzoinated lard is a bland dressing for skin diseases. Asparagin has been recommended as a diuretic in gout and cardiac dropsy, in doses of 0.065 to 0.13 Gm. (or gr. i-ij).

ALUMEN (U. S. P., B. P.).—**Alum** ($Al_2K_2[SO_4]_4 + 24H_2O$).

Preparations.

Alumini Hydroxidum (U. S. P.).—Aluminum Hydroxide. Dose, 0.20 to 1.30 Gm. (or gr. iii-xx).

Alumini Sulphas (U. S. P.).—Aluminum Sulphate. For external use.

Alumen Exsiccatum (U. S. P., B. P.).—Dried Alum (alumen ustum, or burnt alum). Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Glycerinum Aluminis (B. P.).—Glycerin of Alum (about 13 per cent.).

Pharmacology.—The U. S. P. alum is potassium alum (containing not less than $99^1/_2$ per cent. of pure aluminum and potassium sulphate). The British Pharmacopœia recognizes both potassium alum and ammonium alum (aluminum and ammonium sulphate). Alum is in the form of translucent, white, octahedral crystals, with a sweetish, astringent taste and acid reaction. It contains water of crystallization, which can be driven off by heat,

forming dried alum. Ammonia alum, which was formerly the official alum, has very much the same properties, and is often dispensed for alum. The metal aluminum is not official. In appearance it is like silver, but is much lighter and more durable; is useful for making surgical and household utensils.

Physiological Action.—Dried alum is astringent, and is a mild escharotic for fungous granulations. The glycerite (20 per cent.) is useful in cases of tonsillitis or pharyngitis of subacute character. In solution alum condenses tissues by coagulating their albumin, and acts as an astringent.

Therapy.—It checks excessive sweating in phthisis when applied with a sponge (4 Gm. to 473 c.cm., or ʒi-Oj of whisky and water). It is used as an injection in leucorrhœa and in gonorrhœa, and a watery solution of the glycerite is useful as a collyrium in conjunctivitis. In the latter affection **alum-curd** is sometimes applied (2 Gm., or ʒss, beaten up with the albumin of a fresh egg).

In chronic granular conjunctivitis, Dr. W. T. Montgomery, of Chicago, makes use of:—

℞ Cupri sulphat.,
Zinci sulphat.,
Ferri sulphat.,
Aluminis ..... aa | 32 Gm. or gr. v.
Aq. destil. ..... 30 | c.cm. or fʒj.

M. Sig.: Brush upon the inside of the lids once daily.

Applied locally in the form of powder or saturated solution, alum is an excellent styptic. A most useful alum styptic combination is the following:—

℞ Aluminis glycerini, (B. P.),
Alcoholis,
Lin. saponis ..... aa 60 | c.cm. or fʒij.—M.

Compresses soaked in the preparation just formulated, or a solution of alum, may be used to restrain capillary hæmorrhage from wounds, bleeding from the gums, or leech-bites. In epistaxis a plug of cotton moistened in alum-water may be passed into the nares; a solution may be thrown in by injection or powdered alum may be snuffed. These measures will frequently prove successful. In chronic pharyngitis, tonsillitis, and nasal catarrh the local action of powdered alum is beneficial. A prescription composed thus is often effectual:—

℞ Phenol liquefacti..... | 18 c.cm. or *m*iij.
Aluminis glycerini..... 90 | c.cm. or fʒiij.
Thymolis iodidi..... 2 | Gm. or ʒss.

M. Sig.: Apply with cotton or a camel's-hair brush once or twice a day over the surface.

It may also be used in solution as a gargle with good effect. The local application of a solution of alum is of benefit in cases of mercurial ptyalism. Mr. Corson asserts that gargling the throat with 4 to 8 Gm. (or ʒi-ij) of alum, dissolved in about 180 to 210 c.cm. (or ʒvi-vij) of a decoction of barley with the addition of 7.50 c.cm. (or fʒij) of honey of roses, is a serviceable practice in the case of speakers and singers, shortly before using the voice.

An injection of alum is a serviceable astringent in hæmorrhage from

the rectum or in gonorrhœa. For gleet, the following formula is recommended:—

℞ Pulv. aluminis	8	Gm. or ʒij.
Fluidext. geranii	15	c.cm. or fʒss.
Aquæ rosæ	135	c.cm. or fʒivss.—M.

In the vulvitis of children, a solution of a drachm of alum to a pint of water is a serviceable local application and may from time to time be used as an injection. A solution of 0.65 to 473 c.cm. (or gr. x to the pint) is a useful injection in chronic cystitis, as it relieves vesical pain and frequency of micturition, while decreasing the production of ropy mucus.

A lotion containing alum may be successfully employed in the prolapsed bowel of children. From 4 to 8 Gm. (or ʒi-ij) of alum to 473 c.cm. (or a pint of water, or alcohol), is a beneficial application in hyperidrosis. It is said that 0.65 Gm. (or gr. x) of alum, placed upon the tongue, will sometimes arrest a paroxysm of asthma (Ringer). According to Ringer, many cases of chronic ozæna are rapidly relieved by irrigating the nasal chambers with a solution containing a drachm of alum to the pint of water. The discharge is checked and the fœtor removed. Pruritus of the vulva sometimes yields to a hot alum solution. The local astringent action of this substance is sometimes found beneficial in purpura. An ointment containing alum is often useful in herpes, and the same preparation removes the offensive odor of bromidrosis. The following formulæ are of service in the diseases just named:—

℞ Pulv. aluminis	4	Gm. or ʒj.
Phenylis salicylatis	2	Gm. or ʒss.
Bismuth. subnit.	4	Gm. or ʒj.
Ungt. zinci oxidi	31	Gm. or ℥j.—M.

℞ Pulv. aluminis	15.5	Gm. or ℥ss.
Glycerini	30	c.cm. or fʒj.
Aquæ hamamelidis	150	c.cm. or fʒv.—M.

In chilblains, also, a solution of alum has been used with asserted advantage.

As an emetic in croup, a heaping teaspoonful of alum may be dissolved in 120 c.cm. (or fʒiv) of simple syrup, of which a teaspoonful is given every fifteen minutes until vomiting is produced. It is useful in bronchorrhœa and in whooping-cough, especially where the secretion is excessive. Given internally, alum checks hæmorrhage and profuse discharges. Whitla esteems it the best remedy in hæmorrhage of the bowel due to typhoid fever. It may be given with good result in the hæmatemesis dependent upon cirrhosis of the liver and in hæmoptysis. The local action of alum may be aided by its internal administration in the night-sweats of phthisis. It checks excessive production of mucus in chronic gastric and intestinal catarrh, and it relieves the pain of gastralgia and enteralgia. Alum is an efficient remedy in some forms of diarrhœa.

Clysters containing alum have been successfully employed in chronic dysentery, and even in the acute form of the disease have sometimes been found of service. The drug may likewise be given internally in the management of dysentery.

Whitla considers the internal exhibition of alum of service in leucorrhœa. The following formulæ are advised:—

℞ Pulv. aluminis	12	Gm.	or 3iij.
Acidi sulph. arom.	4	c.cm.	or f3j.
Fluidext. geranii	60	c.cm.	or f3ij.
Syrup. zingiberis	90	c.cm.	or f3iij.

M. Sig.: One to two teaspoonfuls in water every half-hour or hour until hæmorrhage is arrested. For hæmoptysis, hæmaturia, menorrhagia, and uterine hæmorrhage.

℞ Pulv. aluminis,			
Phenylis salicylatis aa	6	50 Gm.	or gr. c.

M. et ft. capsulæ no. xx.

Sig.: A capsule three or four times a day. Employ especially in catarrh of the bladder and prostatitis.

℞ Pulv. aluminis	13	Gm.	or gr. cc.
Tinct. kino	45	c.cm.	or f3iss.
Tinct. opii camph.	30	c.cm.	or f3j.
Acidi sulph. arom.	4	c.cm.	or f3j.
Spt. vini gallici q. s. ad	150	c.cm.	or f3v.

M. One to two teaspoonfuls in water every three or four hours. Serviceable in chronic diarrhœa, dysentery, and in hæmaturia.

Some cases have been reported in which alum was thought to be useful in diabetes mellitus. It would probably prove of more decided utility in diabetes insipidus.

In comparatively large doses (2.60 to 4 Gm., or gr. xl-3j) alum acts as a purgative, and has been used in colica pictonum. In this condition it relieves the pain and overcomes the constipation. Dr. Phillips speaks of its being useful in other forms of gastralgia and colic. It has proved of benefit in intermittent fever in 0.32 Gm. (or gr. v) doses, although its action is not uniform in this affection. Iron-alum has been employed in intermittent hæmaturia. For boils in the ear, a solution of aluminum acetate (25 per cent.) may be dropped into the ear frequently, and the canal plugged with cotton. Alum is sometimes used as an adulterant of baking-powder, and its use for this purpose undoubtedly causes indigestion.

The aluminum salts are antiseptic and can be used as injections for leucorrhœa (0.65 Gm. to 30 c.cm., or gr. x-f3j), and saturated solutions are mild caustics. The oleate of aluminum arrests morbid discharges when used as a local application.

ALUMNOL is the trade-name given to a substance discovered by Filehne, of Breslau. It consists of a mixture of aluminum salts of naphtholsulphonic acid, and contains 5 per cent. of aluminum and 15 per cent. of sulphur. Alumnol occurs in the form of a fine white or light pink-colored powder, free from odor, not hygroscopic, readily soluble in water, soluble in glycerin, less so in alcohol, and insoluble in ether. Its solution in alcohol exhibits a beautiful blue fluorescence. The solutions possess an acid reaction. The taste of alumnol is sweetish and astringent. Alumnol precipitates albumin and gelatin, but is redissolved in excess of those substances. It possesses marked penetrative action. It strikes a blue color with solutions of ferric chloride. Alumnol darkens upon exposure to the air, without losing its properties.

Physiological Action.—This substance is antiseptic, astringent, and, in concentrated form, cauterant.

Alumnol exerts no toxic influence, except when employed in very

large quantities and under very favorable conditions for absorption. In practice, no aluminum was found in the urine of patients who had been treated by large doses and for a considerable period.

Therapy.—Alumnol is a serviceable application to ulcers, wounds, and abscesses. It may be used as a lotion, ointment, or plaster. For the irrigation of abscess-cavities it may be used in a 10- to 20-per-cent. solution. A 1-per-cent. solution is beneficial as an injection in gonorrhœa, and in endometritis, due to gonorrhœa, sticks or bougies containing from 2 to 5 per cent. may be employed with advantage.

A 4-per-cent. solution dropped into the eye arrests the flow of tears for several minutes: a property which will, in certain instances, materially facilitate examination.

Dr. Stipanics, of Budapest, has used alumnol with advantage in the treatment of chronic rhinitis, hypertrophic rhinitis, simple ozæna, acute and chronic pharyngitis, tonsillitis, etc. This writer regards the remedy as of special efficacy in affections of the larynx. Hoarseness due to laryngeal catarrh was speedily removed by inhalations of $^1/_2$- to 1-per-cent. aqueous solutions. Dr. Wolffberg recommends a 4-per-cent. solution for the purpose of cleansing the eyes in gonorrhœal ophthalmia. By Dr. Brieger alumnol has been used with success in the treatment of purulent inflammation of the middle ear.

M. Chotzen has reported his experience with this remedy in more than three hundred cases. He describes it as a beneficial application to chancres and chancroids, balanitis, and erosions. Solutions containing from 1 to 5 per cent. are of value in moist and papular eczema, acne, and furunculosis. An alcoholic solution of 2.5 to 10 per cent. is effective in urticaria, sycosis, and psoriasis. Incorporated with lanolin, in the strength of 2.5, 5. 10, and 20 per cent., it is successful in eczema, seborrhœa capitis, psoriasis, and favus. In erysipelas and lupus, alumnol is also employed with good results. In these affections Dr. Chotzen applied the remedy according to the following formula:—

℞ Alumnol	4	Gm. or 3j.
Adipis lanæ	19|4	Gm. or 3v.
Paraffini mollis	13	c.cm. or f3iiiss.
Ceresin[1]	2	Gm. or 3ss.

M. et ft. ungt.

Aluminum acetico-tartaricum.—This compound occurs in the form of almost-colorless pieces, having an odor resembling that of vinegar, a slightly-acid and not disagreeable taste. It is soluble in water, but not in alcohol. It is chiefly used as a mouth-wash and gargle. A 50-per-cent. solution is recommended in the treatment of frost-bite. This substance has been applied also as a dressing to wounds. It is non-toxic, astringent, and antiseptic.

Boral and Cutol.—Aluminum borotartrate (under the name of **Boral**) and aluminum borotannate (under the title of **Cutol**) have been brought forward as antiseptic and astringent preparations, suitable for use in dermatology. Boral is soluble, and cutol is insoluble, in water. The latter may be rendered soluble by the addition of tartaric acid, in which form it

[1] Ceresin is a natural mineral product which closely resembles white wax. It consists of a mixture of solid paraffin with some oxygenated bodies, and is found in Galicia and southern Utah.

is claimed to be useful as an injection in gonorrhœa. Cutol has been employed with alleged success in facial erysipelas.

Aluminum boroformate. — This compound is made by heating together boric acid, formic acid, and alumina. It occurs as large crystalline scales, soluble in water, contains 33.5 per cent. alumina, and has been used as a substitute for other preparations of aluminum. A solution of boroformate, saturated with ammonia and evaporating the clear fluid, constitutes aluminum ammonio-boroformate.

Sozal.—Under this name an organic salt of aluminum has been introduced for use as an antiseptic application. Sozal is obtained by dissolving aluminum hydrate in phenol-sulphonic acid. It is a crystalline substance, readily soluble in water, glycerin, and alcohol. Sozal has an astringent taste and a faint odor of carbolic acid. A 1-per-cent. solution was found beneficial as an injection in abscess, tuberculous ulcers, etc.

ALVELOZ is the milky juice of Euphorbia heterodoxa, belonging to the Euphorbiaceæ: a native of Brazil. The usual irritating effects of the juice of plants of this genus is very marked in alveloz, which is said to act as a caustic upon the skin very much like zinc chloride. It has been used in treating cancerous and syphilitic lesions with asserted success, and the application is comparatively painless.

AMBRAGRISEA.—Ambergris is an odorous, fatty substance, found in large masses floating upon the water, and is believed to be produced in the intestines of the spermaceti-whale. It has a consistence like wax, softening at the temperature of the hand, and melting below the boiling-point of water; it is almost entirely volatilized by heat, and is inflammable. In composition it is like cholesterin, and is not saponifiable. It is believed to have some antispasmodic effects, and is official in the French Codex as a 10-per-cent. tincture. Ambergris is used in making perfumery.

AMINOFORM.—A trade name for Hexamethylenamine.

AMMONIACUM (B. P.).—**Gum Ammoniac.**
Dose, 0.32 to 1 Gm. (or gr. v-xv).

Preparations.

Emplastrum Ammoniaci cum Hydrargyro (B. P.).—Ammoniac and Mercury Plaster (contains ammoniac, 2 oz.; mercury, 3 oz.; with olive-oil, 56 grains; and sublimed sulphur, 8 grains).

Mistura Ammoniaci (B. P.).—Ammoniacum Mixture (ammoniac, 5; syrup of Tolu, 10; distilled water, 150). Dose, 15 to 30 c.cm. (or f℥ss-j).

Emulsum Ammoniaci (not off.).—Emulsion of Ammoniac (4 per cent.). Dose, 4 to 15 c.cm. (or f℥i-iv).

Pharmacology.—Ammoniac is a gum-resin obtained from Dorema Ammoniacum (Umbelliferæ), containing a volatile oil. It occurs in the form of tears, of variable size, hard and brittle, having a faint, unpleasant odor and a bitter-sweet, somewhat acrid, taste. It forms a milky emulsion when rubbed up with water.

Therapy.—It is a stimulating expectorant and laxative, and resembles

asafetida in its effects upon the system. It has been used, with alkalies, to relieve chronic bronchitis and asthma. It is especially beneficial in chronic bronchitis associated with emphysema, or occurring in aged persons. The algid stage of cholera has been treated in the Fiume Hospital by gum ammoniac internally, conjoined with stimulants and the hypodermic injection of ether. Warm baths were also administered. The plasters are useful in glandular and joint swellings. By fusing ammoniac and other resins with caustic potassa **resorcin** is obtained, which is a valuable antiseptic, and is official.

AMMONIUM.—Ammonium has not been isolated and is known only in its combinations, which are numerous and important. According to Ampère, its constitution is NH_4; it is therefore a compound radical, and as such it forms permanent salts which are analogous to potassium salts. Ammonia (NH_3) is a gas, which can be liquefied by pressure. It is soluble in water and in alcohol.

U. S. P. Preparations (Liquid).

Aqua Ammoniæ.—Water of Ammonia (contains 10 per cent. of gaseous ammonia). Dose, 0.12 to 0.60 c.cm. (or *m*ii-x).

Aqua Ammoniæ Fortior.—Stronger Water of Ammonia (28 per cent. gaseous ammonia). External use.

Linimentum Ammoniæ.—Liniment of Ammonia (ammonia-water, 35; alcohol, 5; cotton-seed oil, 60 c.cm.). For external use.

Spiritus Ammoniæ.—Spirit of Ammonia (10 per cent.). Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Spiritus Ammoniæ Aromaticus.—Aromatic Spirit of Ammonia. Dose, 2 to 7.5 c.cm. (or f3ss-ij).

Liquor Ammonii Acetatis.—Solution of Ammonium Acetate. Spirit of Mindererus. Dose, 4 to 15 c.cm. (or f3i-iv).

Tinctura Guaiaci Ammoniata.—Dose, 2 to 4 c.cm. (or *m*xxx-lx).

Tinctura Valerianæ Ammoniata.—Dose, 2 to 4 c.cm. (or f3ss-j).

B. P. Preparations (Liquid).

Liquor Ammoniæ.—Solution of Ammonia (contains 10 per cent., by weight, of ammonia, NH_3).

Liquor Ammoniæ Fortis.—Strong Solution of Ammonia (32.5 per cent., by weight, of ammonia, NH_3).

Liquor Ammonii Acetatis.—Solution of Ammonium Acetate. Dose, 7.5 to 22 c.cm. (or f3ii-vj).

Liquor Ammonii Citratis.—Solution of Ammonium Citrate. Dose, 7.5 to 22 c.cm. (or f3ii-vj).

Spiritus Ammoniæ Aromaticus.—Aromatic Spirit of Ammonia, Spiritus Ammoniæ Compositus, Spirit of Sal Volatile. Dose, 1.20 to 2.40 c.cm. (or *m*xx-xl).

Spiritus Ammoniæ Fœtidus.—Fetid Spirit of Ammonia. Dose, 1.20 to 2.40 c.cm. (or *m*xx-xl).

Linimentum Ammoniæ.—Liniment of Ammonia (solution of ammonia, 25 c.cm.; almond-oil, 25 c.cm.; olive-oil, 50 c.cm.).

Ammonia is contained in several of the B. P. official tinctures, also in the Ammoniated Liniment of Camphor.

Official Solid Preparations.

Ammonii Iodidum (U. S. P.).—Ammonium Iodide. Dose, 0.32 to 0.65 Gm. (or gr. v-x).

Ammonii Salicylas (U. S. P.).—Ammonium Salicylate. Dose, 0.13 to 0.65 Gm. (or gr. ij-x).

Ammonii Valeras (U. S. P.).—Ammonium Valeriate. Dose, 0.13 to 0.32 Gm. (or gr. ii-v).

Ammonii Benzoas (U. S. P., B. P.).—Ammonium Benzoate. Dose, 0.13 to 0.65 Gm. (or gr. ii-x).

Ammonii Bromidum (U. S. P., B. P.).—Ammonium Bromide. Dose, 0.65 to 1 Gm. (or gr. x-xv).

Ammonii Carbonas (U. S. P., B. P.).—Ammonium Carbonate. Dose, 0.13 to 0.32 or 1.30 Gm. (or gr. ii-v or xx).

Ammonii Chloridum (U. S. P., B. P.).—Ammonium Chloride. Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Troschisci Ammonii Chloridi (U. S. P.).—Troches of Ammonium Chloride.

Glycyrrhizinum Ammoniatum (U. S. P.).—Ammoniated Glycyrrhizin. Dose, 0.03 to 0.32 Gm. (or gr. ss-v).

Hydrargyrum Ammoniatum (U. S. P.).—Ammoniated Mercury, White Precipitate. Used only externally.

Ammonii Phosphas (B. P.).—Phosphate of Ammonia. Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Pharmacology and Physiological Action.—Ammonia is a gaseous body, highly irritating, even suffocating, to the air-passages, and may cause acute inflammation with œdema of the glottis. It stimulates the trifacial nerve, increases the blood-tension by reflex action upon the vasomotor centre, and prevents syncope. If applied to the skin it is rubefacient, and, if diffusion be prevented, it will soften and vesicate the skin. The strong solution also produces vesication and softens the cuticle. Ammonium chloride, on the other hand, is cooling and absorbent. The chloride, after absorption, hastens epithelial proliferation of the bronchial mucous membrane and liquefies thickened mucous secretions. The carbonate is probably decomposed in the digestive tract, and its effects are identical with those of the gas or of aqua ammonia in stimulating the heart and circulation.

Ammonia acts upon the ganglionic nervous system especially, and has little effect upon the higher centres, thus differing from alcohol. It increases the functional activity of the spinal cord and is a promptly acting cardiac stimulant. Its accelerator nerves and the heart itself are stimulated by medicinal doses of ammonia. Blood-pressure is moderately increased, but in large doses ammonia interferes with the oxygen-carrying power of the red blood-corpuscles, and if long continued produces emaciation. Ammonia likewise stimulates the respiratory centre. In small doses the aromatic spirit of ammonia acts as an antacid and a carminative; but the protracted use of ammonia, by neutralizing the gastric juice, enfeebles digestion, and may originate gastro-intestinal catarrh. Injected into the blood-vessels, the blood-corpuscles are liable to become dissolved, and after death the blood remains fluid. Ammonia likewise assists in maintaining the solution of the fibrin of the blood. Such injections are likely to be followed by vomiting. The carbonate may be given for the same purpose by the mouth, but, in large doses is apt to cause vomiting. Ammonia increases the secretions not only of the bronchial mucous membranes, but also the intestinal, and may set up diarrhœa. The solution of ammonium acetate acts upon the skin, especially in fever. Ammonia has no special action upon the kidneys, except that the urea is increased by oxidation of ammonia, according to the observation of Dr. Bence Jones, who also found that nitric acid made its appearance in the urine after the administration of ammonia or its salts; it is eliminated especially by the kidneys, broncho-pulmonary tract, and skin. Ammonia possesses marked antiseptic virtues.

Poisoning.—As the ammonia-water, or "spirit of hartshorn," is found

in every household, cases of poisoning by accidental swallowing not rarely occur. When the stronger solutions are swallowed, there is great distress, burning pain along the œsophagus and in the stomach, with choking sensations from inhaling the gas or the admission of a few drops into the larynx. After death there are evidences of softening and acute inflammation of the stomach.

Treatment.—Vomiting is likely to occur immediately, but if not, the administration of large quantities of bland liquid, such as water, oil, or milk, would be serviceable, and if the solution of the gas has been taken it may be neutralized with vinegar or lemon-juice. Treatment should be promptly instituted in order to avoid such a degree of inflammation as would produce stricture of the œsophagus. If the patient is in a state of shock, warm infusion of coffee may be administered by the mouth or rectum and tincture of digitalis, or strychnine given hypodermically. The diet should be liquids only.

Therapy.—The local uses of ammonia have been already intimated. In sprains, bruises, and old rheumatic swellings the liniment is of service, especially if some oil of turpentine or chloroform be added.

The water of ammonia may very serviceably enter into the composition of a stimulating application in alopecia. In the headache, which attends disordered menstruation or the menopause, Dr. Tilt has seen Raspail's sedative lotion afford much relief. This preparation contains 60 c.cm. (or f℥ij) of stronger ammonia, 62.2 Gm. (or ℥ij) of common salt, 9.25 c.cm. (or f℥iiss) of spirit of camphor, and 1 litre (or Oiif℥ij) of water. The liquid may be applied upon a sponge or linen cloth. Weak solutions of ammonia will sometimes relieve the itching of urticaria. For this purpose 7.5 c.cm. (or f℥ij) of the official water of ammonia may be added to a pint of water, or ammonia carbonate may be employed in the strength of 4 Gm. (or ℥j) to 120 c.cm. (or f℥iv) of water. The following combinations of ammonia are also of service for external use:—

℞ Aquæ ammoniæ,
Fluidext. arnicæ,
Lin. saponis,
Olei terebinthinæ ..... aa 60| c.cm. or f℥ij.
M. Sig.: Rub in well several times a day. For rheumatism, bruises, and sprains.

℞ Lin. ammoniæ ..... 60| c.cm. or f℥ij.
Spt. chloroformi ..... 30| c.cm. or f℥j.
Lin. menthol[1] ..... 60| c.cm. or f℥ij.
Tinct. opii ..... 30| c.cm. or f℥j.
M. Sig.: Apply well over the surface, when necessary for lumbago, neuralgia, and sciatica.

℞ Spt. ammon. aromat. ..... 15| c.cm. or f℥ss.
Tinct. capsici ..... 30| c.cm. or f℥j.
Spt. lavandulæ ..... 7|50 c.cm. or f℥ij.
Tinct. nucis vomicæ ..... 15| c.cm. or f℥ss.
Lin. camphoræ ..... 75| c.cm. or f℥iiss.
M. Sig.: Apply with friction to the scalp for loss of hair and for dandruff.

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[1] Linimentum menthol as suggested by Martindale (see "The Extra Pharmacopœia," London) is composed of menthol, 3 parts; chloroform, 4 parts; and olive-oil, q. s. to make 16 parts.

In neuralgia, thimble-blistering may be practiced over the painful spots of Valleix, by dropping some stronger aqua ammoniæ upon absorbent cotton, and confining it with a watch-glass or thimble in contact with the skin.

Spirit of ammonia is a good application to wounds caused by stings of insects or snake-bites. In the latter case, ammonia-water can also be injected into a vein in order to counteract the depressing effects of the venom. In poisoning by sewer-gas intravenous injection of the official aqua ammonia has saved life. Ammonium-chloride solution (8 to 15.5 Gm. to 473 c.cm., or ʒii-iv to Oj) removes ecchymosis from contusions. This solution is applicable likewise to epididymitis after the acute stage has subsided. It is, in fact, an excellent dressing in the latter stage of superficial inflammation, and promotes the absorption of exudation. Dr. J. H. Freeman, of Nevada City, Cal., warmly recommends ammonium chloride in the treatment of rhus-toxicodendron poisoning. He dissolves 8 Gm. (or ʒij) of the salt in 120 c.cm. (or fʒiv) of water, and directs it to be applied to the affected parts two or three times a day. The swelling and the burning pain rapidly disappear.

Internally, ammonia is invaluable as a cardiac and nervous stimulant in pneumonia and all typhoid conditions, in poisoning by prussic acid, in syncope, and in heat-exhaustion. The carbonate is the most eligible form, given in doses of 0.32 to 0.65 Gm. (or gr. v-x). In capillary bronchitis in infants the following answers a good purpose:—

℞ Ammonii carbonatis ..... 75 to 1|50 Gm. or gr. xii-xxiv.
Syr. tolutani ..... 15| c.cm. or fʒiv.
Liq. ammonii acetatis ..... 75| c.cm. or fʒiiss.
M. Sig.: Give a teaspoonful every hour or every two hours.

According to Dr. Beverley Robinson, ammonium carbonate, in rather large and frequently-repeated doses, is very efficient in aborting a cold. The following formula is often most efficient as an expectorant, especially in the late stage of bronchitis:—

℞ Ammonii carb. ..... 4| Gm. or ʒj.
Syr. senegæ ..... 15| c.cm. or fʒiv.
Vini ipecac. ..... 11| c.cm. or fʒiij.
Syrup. tolutani ..... 30| c.cm. or fʒj.
Spt. chloroformi ..... 11| c.cm. or fʒiij.
Aq. camphoræ ..... q. s. ad 120| c.cm. or fʒiv.
M. Sig.: One to two teaspoonfuls every hour or two until relieved.

In the broncho-pneumonia of children, Marfan orders:—

℞ Ammon. acetat.,
Sodii benzoat. ..... aa 1|50 Gm. or gr. xxiv.
Sp. vini gall. ..... 4| c.cm. or fʒj.
Syr. tolutani,
Syr. acaciæ ..... aa 60| c.cm. or fʒij.
M. Sig.: Dessertspoonful every hour or two according to age. The quantity of brandy is also regulated according to age.

The value of ammonium carbonate in scarlet fever has been extolled by Peart, Wilkinson, and Witt. It was employed in 0.20 to 0.32 Gm. (or gr. iii-v) doses, hourly, or at longer intervals, according to the severity of the case. It reduces fever and cerebral excitement and promotes sleep. The solution of ammonium acetate is also highly recommended in scarlatina

The plan is to administer the remedy in large doses, which have been found to be well borne, even by children. The carbonate has likewise been employed in measles, in which disease Ringer states that he has used it largely with considerable benefit. The same salt is valued by some practitioners in the treatment of small-pox and erysipelas.

Delirium tremens, being usually associated with cerebral anæmia and weakened cardiac action, may be benefited by ammonium carbonate.

For the relief of persistent epistaxis, small doses, 0.13 to 0.20 Gm. (or gr. ij-iij), may be given from three to six times a day, or every ten minutes during the hæmorrhage.

Ammonium carbonate and acetate have been used in diabetes mellitus. Eichhorst states that in two of his cases the use of the carbonate was followed by rapid disappearance of the sugar from the urine; yet the progress of the pulmonary lesions was not interrupted.

Pereira says that liquor ammonii acetatis is available in those cases of fever of a continued type where all violent action has subsided and the brain is not much disordered. Its diaphoretic action should be promoted by diluents and by warm clothing.

The aromatic spirit of ammonia may be given in threatened syncope and should be well diluted with water when administered. It is also useful in heat-exhaustion with small quantities of tincture of capsicum, which also relieves nausea. It is likewise of service in the sour stomach and tympanites, which not infrequently occur in hysterical women. Nervous headache is often relieved by the same preparation. Ammonium chloride may be administered thus as an hepatic stimulant:—

℞ Ammonii chlor.	12	Gm. or ʒiij.
Sodii chlorid.	4	Gm. or ʒj.
Fluidext. taraxaci.	60	c.cm. or fʒij.
Decocti aloes co.	ad 240	c.cm. or fʒviij.

M. Sig.: A dessertspoonful to a tablespoonful in water three or four times a day.

The chloride increases the flow of bile (Ringer), and is, therefore, useful in torpor of the liver, sick headache, biliousness, and also in jaundice due to obstruction of the gall-ducts. It has some reputation as an emmenagogue. Ammonium chloride is esteemed of value in catarrh of the stomach and bowels, and Bartholow considers it useful in the first stage of cirrhosis.

M. Marotte esteems this salt as of value in cholera. He administers it in doses proportionate to the severity of the disease and states that it produces a return of warmth and perspiration and also stimulates the kidneys to action. Dr. J. J. Trussewitsch regards ammonia as one of the best cardiac stimulants in cholera. He gives it by hypodermic injection, making use of 3 to 8 drops of the saturated solution diluted with a syringeful of water. The effect is prompt, and continues for some time. It may also be given internally in the same disease.

In myalgia and neuralgia this salt is capable of affording relief, and should be given in rapidly-increasing doses until the effect is obtained or the system becomes intolerant of the remedy. It has also been used in intermittent hæmaturia. It is best given in capsules, on account of its nauseating, sea-water taste. Licorice covers the taste in mixtures.

Dr. H. Campbell's favorite prescription for neuralgia of the fifth nerve is:—

℞ Ammonii chloridi	2	Gm.	or gr. xxx.
Tinct. gelsemii	.50	c.cm.	or *m*viiss.
Tinct. aconiti	.06	c.cm.	or *m*j.
Fluidext. glycyrrhizæ	4	c.cm.	or f℥j.
Aquæ q. s. ad	30	c.cm.	or f℥j.—M.

M. Sig.: To be taken in one dose every hour when the pain comes on, until three doses are taken.[1]

Dr. G. Corrie states that ammonium chloride is an excellent remedy in cystitis from various causes. He gives it in doses of 1 to 2 Gm. (or gr. xv-xxx), and obtains marked and rapid relief.

In bronchitis in its first stage, with deficient secretion, it may be combined as follows:—

℞ Ammonii chloridi	8	Gm.	or ℥ij.
Potassii iodidi	1	Gm.	or gr. xvj.
Tinct. ipecacuanhæ	2	c.cm.	or *m*xxx.
Mist. glycyrrhizæ comp. q. s. ad	120	c.cm.	or f℥iv.

M. Sig.: Dose, a tablespoonful every four hours.

This formula is of special service in acute catarrhal pneumonia. The chloride is particularly valuable in chronic bronchitis accompanied by profuse secretion. It is asserted that the continued use of large doses of this salt may excite ulceration of the stomach. It is also a remedy of great utility in tropical or malarial fevers, such as are encountered in India. In these fevers, of a highly inflammatory type, it must be given in doses not less than 1 to 1.30 Gm. (or gr. xv-xx) several times daily.

Dr. Attygate,[2] of Colombo, Ceylon, reports excellent results from ammonium chloride in acute, tropical dysentery, given in 4 Gm. (or ℥j) doses every four hours and the patient placed on milk-and-arrowroot diet. In the majority of cases blood disappeared from the stools on the third or fourth day. In a few cases this treatment was supplemented by small doses of opium. In India ammonium chloride is esteemed to be especially valuable in malarial fevers of a highly-inflammable type; it should be given in doses of 1 to 1.30 Gm. (or gr. xv-xx).

In catarrhal conditions of the respiratory tract Krakauer recommends the use of ammonium chloride in the form of a spray. Ammonia carbonate may also be used as an emetic in such cases. In the later stages of pneumonia expectoration is promoted by the same remedy. Liquor ammonii acetatis is one of our most reliable diaphoretics, and enters into the composition of many fever mixtures:—

℞ Fluidext. aconiti	.18	c.cm.	or gtt. iij.
Spt. chloroformi	15	c.cm.	or f℥iv.
Liq. ammonii acetatis	75	c.cm.	or f℥iiss.

M. Sig.: Give a dessertspoonful every two or three hours in fever.

Both the ammonium chloride and the solution of the ammonium acetate are effectively given for the purpose of quickly removing the effects of alcohol or sobering a drunken person.

Ammonium bromide has a special influence over whooping-cough, and may be substituted for the potash salt in epilepsy and nervous affections. A

[1] *New York Medical Journal*, Sept. 23, 1899.
[2] *British Medical Journal*, May 7, 1898.

double salt, ammonium and rubidium bromide, has recently been introduced as a remedy for epilepsy. The substance is readily soluble in water. Its dose is that of the other bromides. Active doses are from 2 Gm. (or gr. xxx) upward; as much as 8 Gm. (or 3ij) daily, or even more, may be given, dissolved in syrup of lemon and water. Laufenauer has used it in all the epileptic states with the exception of hystero-epilepsy.[1] In acute rheumatism with nervous symptoms, Da Costa reported good results from the use of ammonium bromide (1.30 to 2.60 Gm., or gr. xx-xl) several times daily.

A very suitable prescription for insomnia and in gouty subjects is:—

℞ Sodii bromidi	21	50 Gm. or 3vss.
Tinct. lupulini	60	c.cm. or f3ij.
Spt. chloroformi	7	50 c.cm. or f3ij.
Aquæ camphoræ	60	c.cm. or f3ij.

M. Sig.: Two teaspoonfuls in water every hour or two when necessary.

The valerate enjoys some reputation for its influence over hysterical manifestations, and may be given in capsules (0.32 to 1.30 Gm., or gr. v-xx) or as an elixir[2] (not official):—

℞ Ammonii valeratis	6	50 Gm. or gr. c.
Elixir aurantii	240	c.cm. or f3viij.
Aquæ ammonii		q. s. ad react. neut.

M. Sig.: Dose, a tablespoonful, well diluted, in nervous attacks of women.

Of the remaining salts little need be said. The phosphate is diuretic and has been used in gout, which may be connected with deficient excretion of urea. The benzoate, where the urine is alkaline, as in cystitis, has advocates, as it is excreted as hippuric acid, and thus prevents phosphatic deposits. The nitrate is only used to prepare nitrous-oxide gas, which it yields by exposure to heat. The sulphate is used in making other salts. The iodide may be employed in syphilitic affections, where the other iodides are too depressing.

In the strength of 2 Gm. (or 3ss) to 30 c.cm. (or f3j) of glycerin, ammonium iodide is recommended as an efficient local application to enlarged tonsils, being painted upon the glands once daily with a camel's-hair brush. Ammonium borate, according to Professor Lashkevich, reduces expectoration and, at times, the pyrexia of pulmonary tuberculosis.

Aqua ammoniæ may be administered by cautious inhalation, hypodermically, or by the mouth, in shock, in chloroform-narcosis, in poisoning by hydrocyanic acid or hydrogen sulphide, and also in heart-clot, thrombosis, and snake-poisoning. Where a prompt effect is needed, the remedy should be injected directly into a vein (0.60 to 1.20 c.cm., or *m*x-xx) diluted with sterilized water.

AMYGDALA AMARA (U. S. P., B. P.).—**Bitter Almond.**

AMYGDALA DULCIS (U. S. P., B. P.).—**Sweet Almond.**

The pharmacopœias recognize two varieties of almond (Rosaceæ): 1. Amygdala amara, the seed of Prunus Amygdalus; variety, Amara. 2.

[1] *Medical Bulletin*, July, 1890.

[2] In the National Formulary the elixir of ammonium valerianate contains vanilla and a little chloroform to cover the odor and taste of the salt, of which there are present 0.13 Gm. (or gr. ij) to 4 c.cm. (or f3j).

Amygdala dulcis, or sweet almond, which is the seed of Prunus Amygdalus; variety, Dulcis.

Preparations.

Oleum Amygdalæ Amaræ (U. S. P.).—Oil of Bitter Almond. Dose, 0.015 to 0.06 c.cm. (or $m^1/_4$-j).

Aqua Amygdalæ Amaræ (U. S. P.).—Bitter-Almond Water. Dose, 15 c.cm. (or f℥ss).

Syrupus Amygdalæ (U. S. P.).—Syrup of Almond, "Orgeat" Syrup (containing both sweet and bitter almonds). Dose, 7.5 to 15 c.cm. (or f℥ii-f℥ss).

Spiritus Amygdalæ Amaræ (U. S. P.), Spirit of Bitter Almonds. Dose, 0.06 to 0.12 c.cm. (or *m*i-xx).

Emulsum Amygdalæ (U. S. P.).—Emulsion of Almond (sweet almonds). Dose, 7.5 to 15 c.cm. (or f℥ii-f℥ss).

Oleum Amygdalæ Expressum (U. S. P.).—Expressed Oil of Almond (either bitter or sweet almonds). Dose, 7.5 to 15 c.cm. (or f℥ii-f℥ss).

Unguentum Aquæ Rosæ (U. S. P., B. P.).—Ointment of Rose-water ("Cold Cream").

Oleum Amygdalæ (B. P.).—Almond-oil (expressed from the Bitter or Sweet Almond).

Mistura Amygdalæ (B. P.).—Almond Mixture (compound powder of almonds, 20 Gm.; distilled water, 160 c.cm.).

Pulvis Amygdalæ Compositus (B. P.).—Compound Powder of Almonds (contains sweet almonds, 20 Gm.; sugar, 10 Gm.; acacia, 2.5 Gm.).

Pharmacology.—Both varieties of almond contain fixed oil and emulsion, but only the bitter variety has also amygdalin. Hydrocyanic acid is formed when amygdalin and emulsin react upon each other, and it is to the acid thus formed that the sedative and antispasmodic effects of oil of bitter almond are due. Its toxic effects are also identical with hydrocyanic acid, and call for the same treatment.

Therapy.—The volatile oil of bitter almond must not be confounded with the fixed oil obtained from either variety by expression, the latter being a bland application, especially in the form of ung. aquæ rosæ, to irritable skin or chapped hands or lips. In doses of 4 to 7.5 c.cm. (or f℥i-ij), it is laxative, and may be used as a substitute for olive-oil. The oil of bitter almond has been employed in emulsion as a local application in pruritus, and internally for the same purposes as hydrocyanic-acid solution. The official emulsion is made with sweet almonds, forms a soothing application, and may be combined according to these formulæ:—

℞ Emuls. amygdalæ	30	c.cm. or f℥j.
Bismuth. subnit.	4	Gm. or ℥j.
Thymolis iodidi	4	Gm. or ℥j.

M. Sig.: For local application to freckles and skin pigmentations.

℞ Emuls. amygdalæ	30	c.cm. or f℥j.
Hydrarg. chlor. corros.	20	Gm. or gr. iij.
Ammon. chloridi	25	Gm. or gr. iv.

M. Sig.: Valuable in skin pigmentations.

℞ Hydrarg. chlor. corros.	.065 to	.13 Gm. or gr. i-ij.
Emuls. amygdalæ	120	c.cm. or f℥iv.

M. Sig.: For external use in acne rosacea.

Under the name of **Resorbin**, Lebermann has introduced a mixture which is said to be very readily absorbed by the skin. It is made by emulsifying purest almond-oil with distilled water, a small quantity of yellow

wax, gelatin, and soap, and is brought to an exact consistence by the addition of a little lanolin. It is recommended as an excellent vehicle for active drugs in medication of the skin, and may be used in ichthyosis, pityriasis, scleroderma, sclerema neonatorum, seborrhœic eczema, prurigo, and scabies. Resorbin will, it is claimed, promote the absorption of mercury by the skin.

Bitter-almond water is a good vehicle in which to administer narcotic drugs. The syrup of almond may be appropriately added to cough-mixtures. The emulsion of almond is an agreeable demulcent, and may very well be employed as a vehicle of more active remedies.

Flour prepared from blanched sweet almonds is used in making bread, cakes, and puddings for diabetic patients. Almond-meal is used instead of soap for the toilet, rendering the skin soft and smooth.

AMYLIS NITRIS (U. S. P., B. P.).—**Amyl Nitrite.** A liquid containing about 80 per cent. of amyl (chiefly isoamyl) nitrite, when assayed by U. S. P. process. (There is also an amyl nitrate; but it never is used internally.)

Dose, 0.015 to 0.32 c.cm. (or $m^1/_4$-v), internally; by inhalation, 0.18 to 0.30 c.cm. (or *m*iii-v).

Pharmacology. — A clear, pale-yellowish liquid, of an ethereal, fruity odor, an aromatic taste, and a neutral or slightly-acid reaction. It is insoluble in water, but soluble in alcohol, ether, and chloroform, in all proportions. It volatilizes at ordinary temperatures, and should be kept in a glass-stoppered bottle, or in small glass pearls, each containing 0.18 to 0.30 c.cm. (or *m*iii-v). Vessels or tubes containing this fluid must be handled with care, as it readily explodes at ordinary temperatures. It results from the reaction of nitric acid upon amylic alcohol, and may be contaminated with nitric or hydrocyanic acid.

Physiological Action.—No local effects are ascribed to this remedy, but when taken internally, by the digestive tract, or by inhalation of its odor, very remarkable phenomena are produced. There is at once observed a flushing of the face, with fulness and throbbing of the temporal vessels, the patient complaining of headache, fulness, and oppression, with giddiness and confusion of ideas. The reflex excitability of the cord is diminished. The brain is indirectly influenced, and its functions exalted by the temporary congestion. The action of the heart becomes excessively rapid, with weakening of the pulse and marked lowering of arterial tension, owing to the general enlargement of the vessels, due to action of the drug upon the muscular coats of the arteries, and not to the nervous system or vasomotor centres. Larger doses occasion failure of cardiac action, arrest taking place in diastole. According to the investigations of the late Prof. Leech, of Manchester, the nitrites affect especially the blood and muscles. They depress the nerve-centres and nerves, but their action in this respect is less marked. Amyl nitrite diminishes oxidation, and the arterial and venous blood both become of the same dark color. Respiration and temperature are both reduced. Sugar appears in the urine after inhalation, probably as the result of increased circulation in the liver. It increases the flow of urine, possibly, in the same way, or because the liver-sugar may act as a diuretic. In poisoning from amyl nitrite the blood assumes a characteristic chocolate color, due to the formation of methæmoglobin.

In some patients the nitrites excite gastric irritation and diarrhœa.

Professor Leech regards these compounds as useful, unirritating diuretics. Amyl nitrite is absorbed and eliminated with great rapidity.

Therapy.—From a consideration of its physiological action Dr. Lauder Brunton was induced to recommend the use of amyl nitrite in the paroxysms of angina pectoris, and clinical experience has shown the value of the remedy. Whether the relief be due to lowering of arterial tension, as Brunton asserts, or to the alleviation of the neuralgic condition, as claimed by Johnson, is not very material, since by inhalation of a few drops of this remedy the patient has complete control over the attacks. Dyspnœa due to other forms of cardiac disease and to pulmonary lesions is also relieved by administration of this remedy. It is particularly adapted to symptoms dependent upon disease of the mitral valve, but aortic incompetence, according to Professor Leech, offers no objection to its use in small quantities when the breathing is oppressed. In asthma, where the spasmodic element is strong, amyl nitrite promptly affords amelioration.

Ultzmann recommended as an injection in chronic cystitis, where the secretion is catarrhal and has a bad odor:—

℞ Amylis nitritis	30	c.cm. or *m*v.
Aquæ destillatæ	120	c.cm. or f℥iv.

M. Sig.: Tablespoonful in water sufficient for a vesical injection.

Amyl nitrite can often be resorted to with benefit for seasickness, especially in this formula, given by Martindale:—

℞ Amylis nitritis	1	c.cm. or *m*xvj.
Alcoholis	7.5	c.cm. or f3ij.
Misce et adde:—		
Pulv. tragacanthæ	38	Gm. or gr. vj.
Aquæ destillatæ q. s. ad	120	c.cm. or f℥iv.

The powdered gum tragacanth should be in a dry four-ounce bottle, into which the amyl solution is poured, and the water added gradually afterward. Shake well. Dose, 4 to 7.5 c.cm. (or f3i-ij).

In epilepsy, tetanus, neuralgia, chloroform-narcosis, and in strychnine poisoning, amyl nitrite has been tried with gratifying results; in whooping-cough it has failed. Benefit results from its inhalation in neuralgic dysmenorrhœa, and it is recommended by Dr. Winterburn for the relief of after-pains. His practice is to saturate a small piece of tissue-paper with 5 or 6 drops of the nitrite and place it in a tightly-corked 8 Gm. (or 3ij) vial, from which the patient can inhale when the pain is severe. Professor Benedikt recommends a mixture of 5 parts of amyl nitrite with 10 parts of volatile oil of fennel, for the relief of angiospastic hemicrania. Five drops are to be poured upon a handkerchief and cautiously inhaled. Amyl nitrite is beneficial in migraine dependent upon local vasomotor spasm.

In anæmic epileptics, the inhalation, immediately before a fit, may sometimes prevent the fit. The remedy should not be given to plethoric epileptics, nor to elderly people with brittle arteries. It is particularly adapted to those cases of epilepsy in which an appreciable interval occurs between the aura and convulsion. Dr. S. Weir Mitchell states that amyl nitrite may be advantageously employed as a means of diagnosis between undoubted *petit mal* and attacks simulating that disorder, but caused by temporary congestion of nerve-centres. In the latter class of cases amyl nitrite intensifies the

paroxysm. Sir Crichton Brown has found this agent specially serviceable in the *status epilepticus*.

Inhalation of amyl nitrite is serviceable in stimulating the heart in the event of sudden failure, which may occur in fatty heart or after hæmorrhage. It has proved beneficial in intermittent coryza. In intermittent fever it will avert or suppress the chill, but is without influence upon the hot stage.

In the treatment of epidemic influenza, or grippe, where pneumonia occurred as a complication, Dr. S. Solis-Cohen[1] had successful results from the administration, internally, of 5 drops of amyl nitrite in alcohol, every three hours, associated with atropine sulphate, 0.0005 Gm. (or gr. $^1/_{120}$), and strychnine sulphate, 0.003 Gm. (or gr. $^1/_{20}$), every five hours; also, for a time, ammonium carbonate, 0.65 Gm. (or gr. x), every hour, at first, afterward at longer intervals. Although recovery was delayed by infection with erysipelas, the patient made a good recovery.

In case of unpleasant, or serious, symptoms after the use of nitrite of amyl, the exhibition of ammonia by inhalation, by the mouth, or intravenous injection, and the hypodermic injection of atropine or ether (ethyl-oxide) with cold water or ice-bag to the head, sinapism to the epigastric region, a mustard foot-bath, at the same time keeping the patient in the recumbent posture, will very soon be followed by relief.

AMYL VALERIANATE, Valerianate of Amyl, is an active preparation, which is regarded as a valuable hypnotic and antispasmodic. It is combined, according to Dr. W. F. Wade's formula, by taking 1 part of amyl valerianate to 19 of alcohol, to which is added amyl acetate in the proportion of 0.06 c.cm. (or *m*j) to 60 c.cm. (or f℥ij). Dose, 0.37 to 0.5 c.cm., or *m*vi-viij). This dissolves cholesterin readily, and is considered better in cases of gall-stone than either chloroform or ether.

Amyl valerianate relieves the pain of hepatic colic and prevents recurrences. It has been found of advantage in muscular rheumatism and in dysmenorrhœa. It is useful likewise in relieving hysterical manifestations. Amyl valerianate is a colorless liquid of pleasant taste.

AMYLENE HYDRAS.—Amylene hydrate is tertiary amylic alcohol (dimethylethylcarbinol).

Pharmacology and Physiological Action.—It is a mobile, colorless liquid, with a camphor-like odor. It boils at 102.5° C. (216.5° F.), and at 200° C. (392° F.) is decomposed into amylene and water. It forms compounds with chlorine, bromine, and with iodine. Oxidation converts it into acetic acid and acetone. Miscible with alcohol in all proportions, and is soluble in eight parts of water.

Harmack and Meyer state that amylene hydrate at first excites, but afterward successively paralyzes, all the nerve-centres. It likewise depresses the temperature. In medicinal doses, 3 to 4 c.cm. (or *m*xlv-f℥j), it is said not to affect the respiration, the frequency of the pulse, or the action of the heart, but acts principally upon the cerebrum. In excessive doses it depresses the medulla and spinal cord, and causes death by respiratory failure. According to the experiments of Peiser, amylene hydrate diminishes the waste of nitrogenous tissue. He therefore regards it as

[1] *Philadelphia Hospital Reports*, vol. i, 1890.

particularly adapted to those cases in which an hypnotic is needed for prolonged use, and in which decided nitrogenous waste occurs.

Therapy.—It may be used as an antispasmodic in doses of 1 to 2 c.cm. (or *m*xv-xxx), given in capsules, in alcoholic solution (mixed with beer or wine), or with mucilaginous preparations. It has been used in insomnia and mania. In mental affections Dr. Hans Evensen regards amylene hydrate as somewhat uncertain, but finds it particularly useful in cerebral anæmia.

It has been given also in delirium tremens, and in nocturnal epilepsy. Nach coincided with Wildermuth as to the efficacy of amylene hydrate in frequent and severe attacks of epilepsy, especially where the bromides have failed. He thinks that *petit mal* and nocturnal epilepsy are much benefited by the drug. It has also been recommended for whooping-cough and to relieve the cough of phthisis. No dangerous after-effects have been observed from the use of this remedy.

AMYLUM (U. S. P., B. P.).—**Starch.**

Preparations.

Glyceritum Amyli (U. S. P.).—Glycerite of Starch (10 per cent.). Local use.
Glycerinum Amyli (B. P.).—Glycerin of Starch (about 12 per cent.).

Pharmacology and Therapy.—The official (U. S. P.) starch is the starch-grains obtained from the fruit of Zea Mays (Gramineæ). The British Pharmacopœia directs that starch be procured from the grains of common wheat, Triticum sativum; maize, Zea Mays; and rice, Oryza sativa. It is an important element of food, and forms a large part of rice, wheat, barley, arrowroot, and other commonly-used carbohydrates for administration to the sick. Starchy food should not be given to young infants, who have not sufficient saliva or intestinal juices to digest them, for they may undergo putrefactive changes in the bowel and cause colic and diarrhœa. Starch in a fine, white powder, becoming adhesive when moist, and is a good application for burns or scalds, and for intertrigo, or chafing in infants. With boiling water the starch-granules swell and burst and a homogeneous mass results, which answers very well as a poultice for alleviating local inflammation. The glycerite is a useful application in some skin affections, though pure glycerin sometimes proves irritant, on account of its affinity for water. Starch is a convenient antidote to most corrosive poisons, when mixed with water. It is a test for free iodine, as it turns blue when brought in contact with this agent. Starch-water is made by mixing up a tablespoonful of starch with cold water to a smooth paste, to which a pint of boiling water is added, while stirring.

℞ Aquæ amyli ..... 30| c.cm. or f℥j.
Bismuthi subnit. ..... 2| Gm. or 3ss.
Tinct. opii ..... |30 to |60 c.cm. or *m*v vel x.

M. Sig.: Inject into the bowel when necessary. Use in diarrhœa after each stool.

ANACARDIUM.—Cashew-nut.

Pharmacology and Therapy. — Anacardium occidentale (Terebinthaceæ) is a small tree, indigenous to tropical America, and naturalized in certain parts of Africa. The nut is inclosed within two shells, between which is contained an acrid, oily liquid, which turns black when in contact

with the air. The principal constituents of this fluid are **Anacardic Acid**, a white, crystalline substance, and **Cardol**, a yellowish or reddish oil.

The juice, or oil, is an active local irritant, and has been employed for the destruction of corns and warts, for the cure of obstinate ulcers, and ringworm. It has also been used as a topical agent in the treatment of leprosy. The tubercles and a portion of skin surrounding them are painted with the oil, which is then rubbed into the skin. After a little oozing a scab forms, and when it falls it is seen that the tubercle is diminished in size. The oil should not be applied to a surface of more than six inches square. In young persons and upon parts where the integument is thin the oil gives rise to violent irritation.

ANETHI FRUCTUS (B. P.).—**Dill-fruit.**

Preparations.

Oleum Anethi (B. P.).—The Oil distilled from Dill-fruit. Dose, 0.03 to 0.18 c.cm. (or *m*ss-iij).

Aqua Anethi (B. P.).—Dill-water. Distilled from the fruit. This is a pleasant carminative and stimulant agent ordinarily employed to relieve flatulence or colic. Dill-water is an agreeable vehicle which derives its value from the volatile oil.

Pharmacology and Therapy.—Dill is the dried ripe fruit of Anethum graveolens (*Fam.* Umbelliferæ), a native of Spain and the south of France. The seeds, as the fruit is commonly called, have a strong aromatic odor, less agreeable than fennel-seed, and a moderately pungent taste. The principal constituent is a pale-yellow, volatile oil, having a hot, sweetish-acid taste.

Dill-fruit has the property common to all aromatics, but is rarely used in this country. In flatulent colic of infants the oil can be given in doses of 0.06 to 0.18 c.cm. (or *m*i-iij) on some sugar; the dose of the fruit to adults is from 1 to 4 Gm. (or gr. xv-℥j).

ANHALONIUM.—The dried tops of Anhalonium Lewinii (Cactaceæ).

Pharmacology.—Mescal buttons, "pellote," have been used, in the religious ceremonies of the Indian tribes of the Southwest, as an intoxicant. Prentice and Morgan,[1] who investigated the physiological action, found that three "buttons" were usually sufficient to produce characteristic effects. Among these are hallucinations of vision, color-phenomena predominating, but with remarkable figures and forms. The mind was comparatively unimpaired, but the muscular system was much depressed. The pupils were dilated. The heart-action was at first slower and stronger, then rose to normal, and was never depressed. There was a sense of fullness of the stomach and occasionally nausea and vomiting. The passage of time was unnoticed, and insomnia existed for twelve to twenty-four hours; in this respect, and in the absence of exhilarating character from the visions, a sharp contrast is offered to cannabis Indica. Similar results were reported by Weir Mitchell. Several very toxic alkaloids have been isolated: **Anhalonine**, or **Pellotine**; **Mescaline**; **Anhalonidine**; **Lophophorine**; also a resinous substance, which appears to be an important constituent. Anhalonine, in decided doses, acts like strychnine as a convulsant and tetaniz-

[1] *Medical Record*, Aug. 22, 1896.

ing agent in frogs. In man, small amounts act like opium, as a calmant, producing only weariness and temporary sleeplessness, in doses of 0.049 to 0.059 Gm. (or gr. $^{7}/_{10}$-$^{9}/_{10}$). After personal experience Dr. Havelock Ellis declares that the phenomena of mescal intoxication are mainly a *saturnalia* of the specific senses, and chiefly an orgy of vision. He believes with Dr. Weir Mitchell, that there is every likelihood that mescal will become popular. It certainly has a great future before it with those who cultivate the vision-breeding drugs. At the same time it is of no little interest to the physiologist and psychologist.

Therapy.—The powdered buttons, fluid extract, and tinctures made from them have been used in the treatment of various conditions dependent upon nervous irritability, and with considerable success. In therapeutic doses (fluid extract *m*ss-j, gradually increased to *m*ii-iij—or 0.025 to 0.20 c.cm.), it does not produce insomnia, but frequently removes its cause, and so conduces to natural sleep; it has been of most use in symptomatic treatment, as in cases of nervous headache and cough, active delirium, mania, hypochondriasis, and melancholia. It has also been used as a respiratory stimulant in pneumothorax and angina pectoris. It has been recommended as an adjuvant to digitalis when used as a heart-tonic.

ANIMAL EXTRACTS, SECRETIONS, AND SERUMS.

Pharmacology.—Various remedies of animal origin are now made use of in therapeutics. They contain certain complex organic compounds of iodine, phosphorus, nitrogen, etc.; in some instances products of bacterial activity (ptomaines, toxins, antitoxins, etc.), and in others some internal secretion of normal glands or organs, which have been ascertained by experiment and observation to be available for the treatment of disease. They consist of extracts of organs, serums, and disease products. For instance, the extract obtained from the sheep's testicle by M. Brown-Séquard, and employed by him and others for the relief of organic and functional nervous disorders and certain constitutional diseases, owes its activity to and is described under the title of spermin hydrochloride, the virtue of testicular fluid having been shown to depend upon the presence of spermin: a substance which is also contained in other glands, especially the pancreas.

Physiological Action.—The injection into the human body of extracts obtained from animal tissues may prove of service by modifying the constitution of the blood, or by supplying to it elements of which it stands in need. It is conceivable that, when the functions of certain organs, especially those concerned in nutrition and sanguification, are suppressed, the introduction of the corresponding serums, secretions, or extracts derived from healthy animals may prove beneficial. Acting upon this theory, preparations representing muscular, nervous, cardiac, suprarenal, renal, and thyroid substance have been employed in practical therapeutics. As to the manner of formation of antitoxins, A. C. O'Sullivan holds that the toxin stimulates the cells of the body to produce the antitoxin, and that it is not the blood-cells, but the tissue-cells, that do so. When we come to inquire what the particular cells are which produce antitoxin, we are met by greater difficulties. Tetanus affords the most promising field for solving this question, because it is evident that tetanic poison acts directly on the central nervous system. Wasserman has shown that an emulsion of

the brain of an animal which is sensitive to tetanus has strong antitetanic properties, while if the animal has been poisoned by tetanus its brain loses this power. Here we have a case of neutralization of antitoxin by toxin, and this, not in the serum, but in the brain-cells themselves. Other experiments tend in the same direction, and we may say that in the case of tetanus, at all events, the cells of the brain, which are those attacked by the toxin, are also those which produce the antitoxin. It is easy to see that such a thing is extremely hard to prove or disprove in other diseases where no specific cells are especially attacked, and, of course, the view goes counter to all the work of Metchnikoff and his pupils on the protective action of the wandering cells of the body. As to the second question, how do the antitoxins act? the facts which have been established are the following: 1. The toxin enters into chemical, or molecular, combination with the cell-protoplasm, and when in this combination is neutralized: *i.e.*, is innocuous for other cells. 2. The toxin enters into chemical combination with the antitoxin, and when in this combination is neutralized. 3. The antitoxin is produced by the cell, and is thrown off by the cell into the blood. 4. The cells which produce the antitoxin are the same cells as those which combine with the toxin. We are almost forced to the conclusion that the element in the blood which proceeds from the cell and neutralizes the toxin in the blood is the same element which neutralizes the toxin in the cell. And so we arrive at the first part of Ehrlich's hypothesis: "That element or group of atoms in the cell-protoplasm which combines with the toxin when it is thrown off by the cell into the blood is the antitoxin." But we have seen that it is the action of the toxin on the cell, and that only, which stimulates the cell to produce the antitoxin; that is to say, when any of the combining groups of the cell-molecules are taken up by the toxin, they are replaced by the cell, and replaced in very much increased numbers, as usually happens in all tissue-regeneration. Ehrlich supposes that these combining groups, when they become numerous, lose their hold on the cell-molecules and pass over into combination with the molecules of the fluid in which the cell is bathed, and so get into the blood, and that the injection of a given quantity of toxin will stimulate the cells to produce many hundred equivalents of antitoxin. But there is more than this, for toxin does not merely combine with cell-protoplasm, it also destroys it. There is plenty of evidence to show that the part of the toxin-molecule which poisons is not the same as that which first combines with the cell-molecule. The toxins of diphtheria and tetanus, when kept in the liquid state, gradually lose their toxic power down to a certain point, but they do not lose their power of combining with antitoxin. It takes exactly the same quantity of antitoxin to neutralize a given quantity of toxin, no matter how long it has been kept or how weak it may have become. In Ehrlich's terms, the haptophore group in the toxin-molecule remains unaltered, while the toxophore group is changed. Thus, the toxophore group is much less stable and less rapid in combining than the other, and hence is probably much more complex. Many facts connected with the infectious diseases receive a ready explanation by means of this hypothesis: *e.g.*, what is a naturally-immune animal? A naturally-immune animal is one whose protoplasm-molecule contains few or none of the groups capable of combining with the toxin in question. Again, the incubation-period of a disease, which appears in poisoning by

toxins as well as by the living organism, is the time in which it takes the poisoning group to get to work after the toxin has been anchored on the cell-molecule by its combining group. Again, it is found that the production of immunity and of antitoxin, although the cause of both is the same, do not at all run parallel to one another in amount. An animal in the early stages of immunization may be hypersensitive to the poison while its blood is full of antitoxin; and, on the other hand, in the later stages animals are often found to be practically completely immune, while their blood yields no antitoxin at all.

Therapy.—1. *Organic Extracts.*—A glycerin-extract of gray matter of sheep's brain has been used by M. Constantin Paul with encouraging results in neurasthenia, locomotor ataxia, and senile debility. Dr. Dana has witnessed amendment in the same class of cases from the use of a glycerin brain-extract, and instances particularly a case of rapidly-advancing bulbar palsy in which marked improvement was effected. Seven months after the beginning of the treatment no trace of the disease remained except slight fatigue after long conversation or mastication. In regard to some of the cases it is specially stated that the injection of water had been ineffectual, a proof that the amendment was not due, as thought by some critics, to mere suggestion. Dr. Julius Althaus, of London, has also given favorable testimony concerning the effect of injections of nervous substance. The brain-extract, which he terms **Cerebrin-alpha** (in order to distinguish it from the alkaloid cerebrin obtained from brain-matter), was prepared by mixing 1 part, by weight, of rabbit's brain with 1 part of glycerin and a 0.5-per-cent. carbolic solution. The extract of the cord is made in the same manner and is called **Myelin-alpha**, to avoid confusion with the myelin which is one of the constituents of the central nerve-fibre. Dr. Althaus found that the extracts were of no benefit when swallowed, as they were decomposed by the gastric juice. When injected into the substance of muscle they were active in the average dose of 0.30 c.cm. (or *m*v). Both agents seemed of equal service in cerebral and spinal diseases. They were beneficial in locomotor ataxia, progressive muscular dystrophy, and in those maladies and conditions mainly characterized by loss of nerve-power. In functional nervous disorders good results were obtained from the use of these extracts alone, but in organic affections they seemed to act chiefly as adjuvants to other treatment. They were useful also in promoting convalescence from acute diseases and in relieving the disabilities of old age. From his experience, Dr. Althaus also dissents from the idea that the results are simply due to suggestion.

Babès has employed an emulsion made by mixing normal brain and spinal cord with broth in the proportion of 1 part of nerve-tissue to 5 of broth. About 4 c.cm. (or f3j) of the mixture was injected and proved useful in cases of epilepsy, melancholia, obstinate insomnia, chronic headache, sciatica, and other disorders of the nervous system.

Spermin hydrochlorate or hydrochloride, according to Professor Poehl and Senator, is the active agent in the orchitic fluid in producing the physiological phenomena chronicled by M. Brown-Séquard, in his communication to the French Academy. It is obtained from the testicular juice of the lower animals by a carefully-conducted process, which protects the product from contamination by infectious micro-organisms and isolates it, chemically pure, as a salt of hydrochloric acid. Spermin is a crystalline

substance, soluble in water and absolute alcohol, but insoluble in ether. It absorbs water and carbonic acid from the atmosphere. From experiments upon rabbits, Dr. Stockwell, of Detroit, declares that this agent produces powerful and prolonged stimulation of the sympathetic nervous system, most strongly manifested through the spermatic plexus. It stimulates the vasomotor centre, increases blood-pressure, and aids oxidation. In toxic doses it induces distressing tetanic spasm and interferes with respiration by spasmodic fixation of muscles, including the diaphragm. Cutaneous hyperæsthesia and increased muscular activity were observed. Sexual erethism was marked in many instances. The hypodermic injection of an extract from the recent testicles of mammals was found by Brown-Séquard[1] to have a stimulating effect upon nutrition, and to be especially active as a restorative in failing nutrition due to old age. Dr. H. P. Loomis, of New York, found that the injections, "as claimed, produce nutritive modifications in the tissues of elderly men, due, probably, to stimulation of the nerve-centres." In tuberculosis this substance has also been recommended.[2] Marked improvement has been reported as occurring in some cases of leprosy after the injection of testicular fluid. In locomotor ataxia and various forms of paralysis the same treatment has been followed by amendment. Several hundred cases of tabes have been treated by this method by different observers and in a very large proportion the symptoms of the disease were unmistakably relieved. In hysteria, on the contrary, little or no good has resulted from the injections. They were also found inefficient in epilepsy. In delirious epilepsy and in various forms of insanity the practice has been followed by improvement. In anæmia, also, good results have been obtained. Brown-Séquard claimed that testicular fluid had been used with decided advantage in about 100 cases of cancer, in nearly all of which cessation of pain and hæmorrhage and cicatrization of ulcers demonstrated the efficacy of the method which he advocated. He also asserted that he was cognizant of cases of disappearance of uterine fibromata and of morbid deposits of connective tissue in the heart, arteries, and muscles. It is stated by those who have practiced this method that better results have, as a rule, been obtained in organic than in functional diseases. In chorea, however, Professors Ollier and Tessier and other writers have witnessed rapid improvement in consequence of these injections. Notable amelioration has, in a large number of cases of tuberculosis, followed the use of these injections. Professor Poehl, of St. Petersburg, is of the opinion that the injection of spermin is of service in Asiatic cholera, particularly in the early stage of the disease.

The injections of an extract were followed by relief in cases of insomnia, hypochondria, feeble heart, cardiac asthma, and spinal irritation, as reported by Dr. H. C. Brainerd, of Cleveland.

The most decided results from the use of animal tissues or extracts have been observed following the administration of **Thyroid** preparations, especially in the treatment of myœdema.[3] This disease depends upon

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[1] See paper by the author on "The Case of Dr. Brown-Séquard," *The Times and Register*, Nov. 30, 1889.

[2] See lecture by Dr. D. Uspenski, on "Brown-Séquard Fluid in Tuberculosis," in *Deutsche medizinal-Zeitung*. Dec. 29, 1890.

[3] See report of London Clinical Society, *Lancet*, Feb. 4, 1893; also the *British Medical Journal*, Feb. 4, 1893.

abolition of the functions of the thyroid gland. Dr. Murray, of New Castle, England, demonstrated that grafting of a healthy thyroid upon the body of the patient or the injection of an extract made from the gland is followed by remarkable and rapid amelioration. Thyroid extract is made by cutting the gland into thin slices, bruising, and adding about 4 c.cm. (or f3j) each of glycerin and sterilized water to each gland. After standing for twenty-four hours the fluid, which is thick and of a dull-red color, is strained. The quantity of the extract thrown in is 1.55 c.cm. (or *m*xxv), and the operation is repeated once or twice a week, according to the severity of the case and the rate of improvement. At the end of a month or six weeks the condition has generally been so signally benefited that the procedure can be practiced at longer intervals. The extract is prepared by mincing the gland, freshly taken from a healthy animal, maceration, and filtration under pressure. The preparation and injection should be made with every antiseptic precaution. The numerous favorable cases, in all stages, which have been reported, leave no room for doubt that in this method we have acquired an effective weapon against a disease which had been unamenable to any other mode of treatment.

It has been demonstrated by Dr. Hector Mackenzie, of London, and Dr. E. L. Fox, of Plymouth, that the administration of the thyroid or a glycerin-extract of the gland, by the mouth, is, perhaps, as efficacious as the injection. The gland may be given raw, finely chopped, seasoned, and added to beef-tea, or it may be lightly fried. Thorough cooking would probably destroy its virtue. It is not necessary that a large quantity of the remedy should be taken. Half a gland or, at most, one gland, or an equivalent quantity of the extract, twice a week, is sufficient, and if a proper amount is exceeded vomiting and increased frequency of the pulse are produced. Caution must be enjoined as regards the sudden resumption of physical exercise when improvement takes place. A sudden or excessive strain upon a weakened heart may occasion syncope.

Glandulæ Thyroideæ Siccæ (U. S. P.).—Desiccated Thyroid Glands. Thyroideum Siccum (B. P.). Dry Thyroid is "the cleaned, dried, and powdered thyroid glands of the sheep (*ovis aries*), free from fat." **Liquor Thyroidei** (B. P.) is a liquid that contains the products of the fresh and healthy gland, in a 0.5-per-cent. phenol solution with glycerin. The dose of the powder is 0.06 (or gr. j), given in capsule, three times a day, to be gradually increased to 1 Gm. (or gr. xv). The dose of the liquid is 0.30 to 1 c.cm. (or *m*v-xv).

Dr. S. Solis-Cohen has observed that thyroid extract has a very decided diuretic power, and has employed it with satisfaction as a diuretic in a patient with no apparent disease of the thyroid gland. He speaks also of a case of acromegaly in which the administration of the same remedy alleviated headache, and suggests that it may be of service in a recent case by preventing or retarding enlargement of the pituitary body.

Hertoghe, of Antwerp,[1] has found that the continued administration of the thyroid extracts exerts a depressing effect upon the functions of the pelvic organs and a stimulating effect upon the lacteal glands; in every case menorrhagia was cured by them and menstruation became normal, while the lacteal secretions were remarkably increased. He also recommends it for all congestive disturbances of the pelvic organs.

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[1] *Bull. de l'Acad. de Méd. de Belgique.*

In some forms of amenorrhœa, especially of the congestive variety, thyroid extract in small doses may be employed with asserted good results. At a recent meeting of the Liverpool Medical Institution Dr. Glynn related that in young girls in whom temporary amenorrhœa, or a delay in menstruation in consequence of slight developmental changes occurred, the administration of thyroid extract in doses of 0.03 Gm. (or gr. ss) at bedtime proved sufficient to re-establish the function of menstruation.

Byrom Bramwell and Arthur T. Davies have reported several cases of stubborn psoriasis and eczema which were cured by thyroid feeding or the use of tablets of thyroid extract. Bramwell was led to make use of this agent on account of its favorable effect upon the skin in myxœdema.

Bruce[1] reports his observations with thyroid extract in twenty-three cases of insanity, including mania, general paralysis; puerperal, lactational, climacteric, syphilitic, and alcoholic insanity; he found that, to obtain benefit from this treatment, it was necessary in some cases to give massive doses (4 Gm., or gr. lx, daily). Its administration is contra-indicated in cases of mania where the excitement is acute, the loss of body-weight rapid, and danger of exhaustion from malassimilation of food; but a course of the thyroid treatment led to ultimate recovery, where the recovery had been protracted, or where a tendency to drift into dementia existed, and especially in the insanity of the adolescent, climacteric, and puerperal periods.

The greatest value of thyroid medication has been demonstrated in cachexia thyreopriva, myxœdema, (both in the adult and in the infant), and in cretinism. After the treatment has been carried on for only a few days, improvement in bodily and in mental condition becomes very noticeable. The normal appearance of the features and the various structures gradually is restored. There is loss of weight, increase of strength, return of perspiration and of hair growth, together with a great improvement in the mental condition. This remedy, however, is not curative, unless on condition that its use (in smaller doses) is continued during the life time of the patient. This is due to the fact that it supplies to the system some substance which it is the function of the normal gland to supply, but which is deficient on account of atrophy, loss or destruction of the thyroid. In order to maintain the good results from thyroid feeding, the remedy may be given in small daily doses, or may be given in full doses for a few days each month. A dose of five grains twice a week has been found to be sufficient to keep a patient in an apparently normal condition. The improvement in cretins is very notable from this treatment, especially in the rapid increase in growth.

In carcinoma thyroid extract has been found to have a decided curative action, favoring fatty degeneration and atrophy of the growth.

Dr. J. D. Menzies, of the British navy, reports several cases in which thyroid tablets were of advantage in precocious malignant syphilis, specific medication being suspended. Dr. N. Yorke-Davies asserts that, in the treatment of obesity, the use of these tablets is of great assistance.

The advantages claimed for the method are that it effects positive results and this without restricting the patient's diet or his ordinary habits of life as regards exercise and occupation; but certain well-marked subjective disturbances—such as palpitation, restlessness, tremor, and insomnia—go hand in hand with the improvements, and give the individual more or less

[1] *Journal of Mental Science*, No. xli, 1895.

discomfort. Thyroid tablets are sometimes used by patients without medical advice, and commonly for the reduction of adipose. G. Carriére (*Nord Médicale,* Lille, November 1, 1905) has seen six cases of sudden angina, pulmonary œdema, acute asystolia, from such unauthorized use of the remedy. The symptoms were violent and alarming, but the suppression of thyroid medication banished them completely and permanently. Some fatal cases have been reported. The toxic effects from this agent are grouped together under the general title of **Thyroidism.** The principal contra-indication is to be found in constant, greatly-increased nitrogen excretion, an index of pathological albuminous breaking-down, and which cannot be terminated by simply cutting off the drug, but continues for an indefinite length of time after its administration has been stopped.

Thyreoglobulin constitutes about 10 per cent. of the gland (wet) and contains the iodine constituent of the thyroid in the original form it has in the gland. According to Oswald,[1] thyreoglobulin was found to have the same influence on the excretion of nitrogen in animals in metabolic equilibrium as the entire gland. His view is confirmed by its action in two cases of myxœdema. He obtained from thyreoglobulin a product resembling iodothyrin (supposed to be the bearer of the specific qualities of the gland), but containing 14.3 instead of 9.3 per cent. of iodine.

Dr. Charles Macalester, of Liverpool, used preparations of the **Thymus Gland** with advantage in cases of pseudohypertrophic paralysis and general lymphadenoma.

Mikulicz, in ten cases of goitre and one of Graves's disease, obtained encouraging results from the use of thymus glands. He gave at one dose 10 or 15 Gm. (or 3ii $^{3}/_{4}$-iv) of raw sheep's thymus, finely cut up and spread upon toast. The quantity was gradually increased to 25 Gm. (or 3viss).

Nephrin, a saline, glycerin extract of the cortical substance of the kidney, has been proposed as a remedy in cases of nephritis. Subcutaneous injections of nephrin will, it is thought, prove of service in the treatment of uræmia. M. Dieulafoy has described the results of his experimental use of nephrin in an aggravated case of uræmia. The patient suffered with suppression of urine, œdema of the lung, copious perspiration, and diarrhœa, an abundance of urea being contained in the excreted fluids. After injections of nephrin, urine was again secreted, sweating of urea ceased, the mind cleared, and the patient was able to speak. Further clinical experiments have been made by Teissier and Fraenkel. These observers found that the injection of a glycerin-extract of sheep's kidney in patients suffering from nephritis augmented the power to excrete toxic substances in the urine. The subjects experienced a sense of general amelioration. Albumin, at least in some cases, disappeared from the urine during the days when the injections were given. There was little or no influence upon the quantity of urine passed.

Glandulæ Suprarenales Siccæ (U. S. P.), Desiccated Suprarenal Glands, are "the cleaned, dried, and powdered suprarenal glands of the sheep (ovis aries), or ox (Bos taurus), freed from fat." This substance has been found to possess extraordinary astringent powers upon the smaller blood-vessels, causing intense anæmia when applied to the surface of mucous membranes. The adrenal extract, owing to its convenience and activity, is

[1] *Münch. med. Woch.,* 1899, xxxiii.

largely used in order to produce bloodless operations in nasal surgery. Extensive operations upon the septum, or upon the turbinated bodies, are now performed without hæmorrhage by means of a preliminary application of a solution, which may be prepared as follows:—

℞ Glandularum suprarenalum siccarum	4	Gm. or 3j.
Acidi borici	1	Gm. or gr. xvj.
Aquæ cinnamomi	15	c.cm. or f3iv.
Aquæ camphoræ	30	c.cm. or f3j.
Aquæ destillatæ q. s. ad	60	c.cm. or f3ij.

Macerate for four hours, then filter. The solutions should be hot.

Dr. E. A. Peters[1] has used a 10-per-cent. solution of the suprarenal extract for the pain in carcinoma of the mammæ, stricture of the œsophagus, tuberculosis of the larynx, and periodontitis. In none of these patients was there any apparent deleterious effects.

Suprarenal extract has also been used in Addison's disease, with gratifying results in some cases, beginning with 0.13 Gm. (or gr. ij) three times a day and gradually increasing until 1.30 Gm. (or gr. xx) are taken daily. extract, for the pain in carcinoma of the mammæ, stricture of the œsophagus, tuberculosis of the larynx, and periodontitis. In none of these patients were there any apparent deleterious effects.

In 1901, Takamine and Aldrich, working independently, isolated the active principle of the suprarenal gland, **Adrenalin** ($C_{10}H_{15}NO_3$), which occurs as a light, white, microcrystalline powder, of a slightly-bitterish taste, leaving a numbed feeling on the spot of the tongue where it is applied. The names **Epinephrin** and **Suprarenin** have been applied to similar derivatives, by Abel and von Fuerth. Experiments showed that a drop of an aqueous solution in the strength of 1 to 10,000 blanched the normal conjunctiva within thirty to sixty seconds. Dr. Emil Mayer[2] gives his results with the use of this agent in thirty-five rhinological operations. He found that an application of a 1 to 1000 solution produced blanching of the tissues within a few seconds, the operations being either bloodless or attended with very little hæmorrhage, and in no instance was there any constitutional disturbance.

Dr. E. Fletcher Ingals[3] suggests that, if adrenalin is dissolved in a normal salt solution, it lessens the pain and smarting. He has found that a 1 to 5000 in normal salt solution acts with the same rapidity and intensity as the solution made with 2 Gm. (or gr. xxx) of the desiccated gland to 30 c.cm. (or f3j) of water. In acute coryza, acute laryngotracheitis, and acute laryngitis this agent has promptly reduced the swelling and congestion, and in a few days the patients were well. In order to prevent fungous formations in these solutions Dr. Ingals has suggested the following: 1 part of adrenalin to 5000 of liquid containing 0.50 Gm. (or gr. viij) of boric acid, cinnamon, and camphor-water, of each, 7.5 c.cm. (or f3ij); and distilled water, 15 c.cm. (or f3ss).

Abel[4] gave the name of **Epinephrin** to a body he isolated from adrenal extract, and to which he attributes the well-known effects on blood-pressure of this substance. From the reactions of epinephrin it would seem

[1] *Lancet*, March 2, 1901.
[2] *Philadelphia Medical Journal*, April 27, 1901.
[3] *Journal of the American Medical Association*, April 27, 1901.
[4] *Zeitschr. f. physiology. Chemic*, xxviii, p. 318.

to belong to the group of animal alkaloids, and it is either identical with adrenalin, or is a derivative from it. It is obtained from aqueous extracts of the adrenals by the action of benzoyl-chloride, and from the benzoyl combination thus formed Abel isolated the free base, and made a picrate, bisulphate, hydrochlorate, and hydrobromate, as well as a triacetylnephrin and a phenylhydrazin derivative. Its various decomposition reactions seem to assign to epinephrin a place among the pyrrol or skatol bases; treatment with dilute alkalies forms a dark pigment, which the author denominates as epinephrinic acid, and a base of coniin- or pyridin- like odor. On fusion with potassium, appreciable quantities of skatol result.

The free base cannot be produced except at the expense of its physiological efficacy. On the other hand, most of its salts react on the system very enegetically; they have a slightly-bitter taste, cause a partial anæsthesia of the tongue, and produce a local vasoconstriction. When introduced into the circulation, small doses at first excite and then centrally depress respiration; heart-failure follows larger amounts. The insolubility of the preparation, however, which increases on keeping, unfortunately renders it of less avail therapeutically than might otherwise be expected; since the toxic dose is far above that required to produce the physiological action. Uroërythrin, the normal pigment principle of the urine, in part exhibits similar properties to epinephrin, and the probability of a relationship between the two bodies seems very great.

Extractum Pancreatis.—Many cases of diabetes are dependent upon or at least associated with disease of the **pancreas.** It has been demonstrated by Minkowski and von Mering that removal of the pancreas causes glycosuria, irrespective of the nature of the diet. If, however, only a small proportion of the gland is left behind, diabetes does not develop. Furthermore, when pieces of the pancreas taken out of the abdominal cavity were grafted into the abdominal wall the advent of diabetes was prevented. Minkowski was led to believe that the pancreas performed some function indispensably necessary to the normal transformation of sugar within the organism. Professor Lépine has ingeniously argued that the pancreas generates a ferment which is necessary to assimilation of amylaceous foods. In view of these facts and hypotheses it was thought that the ingestion of the pancreas or preparations derived from that viscus might prove serviceable in the treatment of some forms of diabetes. Clinical experiments have been accordingly made in that direction and the results, which, unfortunately, fall far below expectation, have been published by Mackenzie, Hale-White, Neville, Wood, Battistini, and N. S. Davis (Jr.). The patients subjected to this method have generally experienced improvement of subjective symptoms, and some have gained in weight. The quantity of urine was not, as a rule, decreased; in one case reported it was even increased. The specific gravity and urea were uninfluenced, and in most cases the amount of sugar was not materially lessened. In one case ingestion of raw pancreas was followed by a severe erythema, accompanied by fever. We may, nevertheless, agree with the conclusion of Mackenzie: "For myself I would rather find an improvement in the general condition of the patient, increased strength, diminished thirst, and diminished quantity of urine as a result of treatment, than a mere diminution of the amount of sugar in the urine without such improvement. . . . It is evident that liquor pancreaticus is no specific, but the effects in these cases are encouraging enough to induce me to make

further trial of it, and it is possible that in cases of true pancreatic diabetes the benefit might be greater."

The United States Pharmacopœia recognizes as official **Pancreatinum**: a powder which consists of the enzymes naturally existing in the fresh pancreas of warm-blooded animals. The British Pharmacopœia contains **Liquor Pancreatis**: a liquid containing the digestive principles of the fresh pancreas of the pig. These preparations are used mostly as digestive agents, especially in those diseases and conditions where starch and fat are imperfectly digested (see **Pancreatinum**). As these preparations contain the active principles of pancreas, and are more palatable than the raw gland, they may be administered in those cases of pancreatic diabetes where irritability of the stomach is a prominent feature. The injection of pancreatin into malignant growths has been recently advoocated.

An extract prepared from the **Parotid Gland** has been used in doses of 0.13 to 0.32 Gm. (or gr. ii-v) in some of the functional disorders of the pelvic viscera, especially ovarian neuralgia, with gratifying results. Improvement has also been noted in acromegaly after the use of an extract from the **Pituitary Gland**; and preparations of **Cardiac Tissue** have been injected hypodermically for the relief of weak heart.

Bone-marrow has been given with decided advantage in anæmia by Dr. J. Dickson Mann, of Manchester, and Professor Fraser, of Edinburgh. The part which marrow performs in the development of red corpuscles allows us to believe that in this substance we have gained a valuable remedy. Dr. Mann thinks that, as the tissue-forming power is more active in young than in old animals, the bones of the former are preferable as a source of marrow-extract. The extract which he employed was made from the heads of long bones of animals freshly killed, together with other portions of bone which contain red marrow. The bones are broken into small pieces and digested in glycerin with frequent agitation. Several days are required to accomplish complete extraction. The result, after filtration, is of a red or reddish-brown color and has no unpleasant taste or odor. It may be given in teaspoonful doses once or twice a day, either by itself or spread between thin slices of bread. Dr. Mann gives the results of a case of hæmophilia in which extract of bone-marrow was employed. A boy had been repeatedly treated for attacks of hæmorrhage which had left him the subject of pronounced anæmia. After a few weeks of treatment by bone-marrow a marked increase in the number of red corpuscles had occurred and his face acquired a healthy color. The same result was obtained in anæmia from other causes. Professor Fraser's case was one of pernicious anæmia, which had lasted for about four months, when the patient entered the hospital. Treatment by means of iron and arsenic, both alone and combined, was altogether ineffectual, and the proportion of red globules and hæmoglobin steadily fell. After the administration of bone-marrow—which was given, uncooked, by the mouth—improvement was almost immediate, the quality of the blood began to change, and at the end of six months the man was practically in a normal condition. Dr. W. G. Bigger has published the history of a case of leukæmia, which was apparently cured by the use of bone-marrow, given raw, spread upon thin slices of bread, and produced a remarkable improvement in the symptoms of the disease. At the end of several months the boy was reported as perfectly well and the spleen of normal size.

2. *Serums and Antitoxins.*—**Blood** has been used as a restorative for

many years, both by the stomach and by transfusion. Solares strongly recommends the serum from the blood of bullocks as a nutritive agent in wasting disease, especially in children. He considers it superior to muscle-juice, in tuberculosis. It may be given by the mouth or the rectum. An interesting field of investigation relates to the employment of **Blood-serum** as a bactericidal agent and to the modification of the blood by means of bacterial products and the production of immunity or cure. The fundamental principle is the alteration of the serum in such a manner as to render it destructive to certain specific bacterial products. This method of research has been applied experimentally to several dangerous infectious diseases. Tetanus was one of the first maladies to be thus studied. Behring has conducted a series of experiments with a view of first rendering an animal immune to tetanus by inoculation with the toxin elaborated by the bacillus of that disease, and, secondarily, utilizing the serum of the immunized animal as a curative remedy for the established disease in another animal or in man. Immunity is secured by successive injections with the toxin of tetanus in gradually-increasing doses. He believes that he has proved that injections of the immunized serum into the subjects of tetanus will cure that disease. The quantity of the modified serum must bear a certain proportion to the body-weight; so that much more is required for men than for small animals. Dr. Behring succeeded in preparing a standard serum or **tetanus antitoxin.** The longer the stage of incubation and the more chronic the course of the malady, the more favorable is the effect of the injections. A number of cases in the human subject have been reported in which recovery appeared to be due to the employment of this method. The injections are said to be in themselves harmless. In one of the successful cases the period of incubation was only six days. Dr. Joseph F. Hobson, of Cleveland, reports the successful treatment of a case of tetanus, which developed on the tenth day after a compound fracture of the tibia. An injection of 10 c.cm. (or f3ii $^{3}/_{4}$) of the serum was given, and repeated at intervals of four to six hours for the next five or six days, when, owing to improvement, they were given with less regularity. Besides the serum, chloral hydrate, 1 Gm. (or gr. xv), and hyoscine hydrobromide, 0.0006 Gm. (or gr. $^{1}/_{100}$), were given every four hours; also morphine sulphate hypodermically, 0.016 Gm. (or gr. $^{1}/_{4}$), was given about four times daily when the patient was sleepless or nervous. The local wound was not laid open, as it appeared healthy. Recovery followed, the serum being discontinued on the tenth day. These procedures and their results have not failed to meet with adverse criticism, but in view of the inadequacy of former methods the path of inquiry is certainly legitimate, and it is probable that it will lead to an effectual means of combating a severe disease. The antitetanic serum is now also prepared in a dry state and sent out in tubes each containing 4 or 5 Gm. (or 3i-i $^{1}/_{4}$): a quantity rather larger than the minimum dose regarded as curative in the case of a man. The dose varies according to the severity of the symptoms, and is repeated for several days in smaller quantity. The dried serum is to be dissolved in distilled water and subcutaneously injected. Several cases of recovery from tetanus of traumatic origin have been reported, in which intracerebral injections of antitoxin were given, in connection with other treatment. Roux and Borrel, from experiments at the Paris Pasteur Institute, demonstrated that the tetanic toxin is extracted from the blood and is fixed by the nerve-cells,

while the tetanic antitoxin, when injected into animals, remains in the blood; so that the antidote does not come in contact with the poison, and the two substances, though so near to each other, fail to meet. This explains why, in man as well as in animals, the subcutaneous and intravenous injections so often fail, for when they are resorted to the nervous system, as pointed out also by Dr. George G. Rambaud, has already fixed a smaller or greater quantity of the toxin, and while the antitoxin, thus administered, neutralizes the toxin circulating in the blood and limits the poisoning, it does not reach that which is attached to the cerebral or spinal cells. Of 45 tetanized guinea-pigs, treated with intracerebral injections, 35 recovered; of 17 others, treated with simple subcutaneous injections, only 2 survived; of 17 not treated with antitoxin at all, all died.

The technique of the operation in man is simple. After the removal of a small button of bone by a trephine ($^1/_4$ inch), the intracerebral injection is made, into a neutral area, such as the forepart of the frontal lobes. The quantity of the serum injected is small (5 to 6 c.cm. of a concentrated serum made by drying 10 parts and thus redissolving in 5 parts) by the slow introduction of which any undue compression is avoided. In addition to the intracerebral injection, it is necessary to give antitoxin intravenously or subcutaneously for a few days, so that thereby the toxin circulating in the blood and any that may later be secreted at the site of injury, may be neutralized before it can affect the nervous centres. Out of 9 cases thus treated, collected by Rambaud, 4 recovered and 5 died. Successful cases have been likewise reported by Dr. Charles A. Church, of Passaic, N. J.; Dr. E. Forgal, Montpellier, France; and Dr. Semple of the Army Medical School at Netley, England.[1]

Serum Antidiphthericum (U. S. P.).—Diphtheria Antitoxin. This is a fluid separated from the blood of a horse, Equus Caballus, L, immunized through the inoculation of diphtheria toxin. It should be kept in sealed glass containers, in a dark place, at temperatures between 4.5° and 15° C. (40° and 59° F.). Behring originally obtained a curative serum from the blood of sheep which had been rendered immune to diphtheria. This serum has been clinically employed by Heubner, Henoch, von Bergmann, Kossell, and other observers with encouraging results.

Highly-satisfactory results are obtained from the official serum, which is now universally made from horse-serum. Diphtheria antitoxin of good quality is now manufactured in this country by many municipal laboratories, also by H. K. Mulford & Co., of Philadelphia; Parke, Davis & Co., and Frederick Stearns & Co., of Detroit, and others.

The use of diphtheria antitoxin is not altogether free from accident. The injections may occasion erythema, urticaria, fever, swollen glands, arthritis, hæmaturia, and albuminuria. They have also been thought to favor an increased tendency to paralysis. Several deaths have been reported directly following an injection of antitoxin. Owing to the precautions taken at present in the manufacture, such accidents are now extremely rare. The usual custom is to administer a maximum dose once daily (1000 to 1200 units), but Dr. John H. Musser advocates giving smaller doses (500 units) and repeating them every four or six hours, according to effect. Accumulating experience having shown the safety of this agent, larger doses are now

[1] *British Medical Journal*, Jan. 7, 1899.

advocated. The ordinary dose given by some[1] is 2000 units, and this may be repeated every three hours in a severe case. Every care should be taken to obtain fresh antitoxin and to sterilize thoroughly the hypodermic needle and place of injection, which is usually in the lumbar region, or buttocks, or between the shoulders, or under the skin of the abdominal wall. The guiding principle in the administration of the serum is that it must be given until the characteristic effects are produced, namely: shriveling of the false membrane, diminution in nasal discharge, correction of fetid odor, and general improvement in the condition of the patient.

Edwin Rosenthal[2] has taken much pains in obtaining statistical information respecting the mortality records in cases of diphtheria, and with this end has obtained reports from one hundred and fifty-seven cities, in the United States, having organized bureaus of health. A summary of the results is as follows:—

Number of cases previous to the serum period, 182,256, with a mortality of 38.4 per cent. Number of cases since the antitoxin period, 132,548, with a mortality of 14.6 per cent. The latter were not all treated with serum; in computing those cases treated with the serum alone the mortality was 9.8 per cent.

Jefferis Turner[3] records his experience of the treatment of diphtheria in the Children's Hospital, Brisbane, and compares the results obtained since the injection of antitoxin was begun in that institution with those observed in the same hospital in the preantitoxin period, from July, 1889, to January, 1895. As regards laryngeal cases, in the author's experience an average mortality of 59.2 per cent. for the preantitoxin period has been reduced to an average mortality of 18.6 per cent. since the use of antitoxin. During the same periods, whereas formerly only 8.4 per cent. of the laryngeal cases recovered without operation, since the introduction of antitoxin an average of 38.4 per cent. have recovered without operation. As regards operation cases alone, whether intubation or tracheotomy, or both, the average mortality of 65.7 per cent. for the preantitoxin period has been reduced to an average of 28.4 per cent. for the antitoxin period. The author states that in the five years that have elapsed since the introduction of the use of antitoxin, "the diminution in the hospital mortality of diphtheria has been nothing short of marvelous to all but a few who had made themselves acquainted with the thorough and unimpeachable experimental basis on which the new treatment had been based." He emphasizes the importance of its early administration, and concludes that, with certain necessary qualifications, such as the occasional difficulty of diagnosis during the early stages, "no child ought to die of diphtheria."

Pneumonia Serum.—Drs. G. and F. Klemperer recommend a curative serum for croupous pneumonia. Immunity in rabbits was produced by injections of saliva from patients, a glycerin extract of pneumococci, and, under certain conditions, bouillon-cultures. Immunized serum acts with more certainty when injected directly into the blood-current, and is believed to neutralize the poisonous products of the pneumococci. These investigators conclude that "we have in the serum of immune rabbits, the poisonous

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[1] *New York Medical Journal*, November 14, 1903.
[2] *Medical Press*, Sept. 19, 1900.
[3] *International Medical Journal of Australasia*, Dec. 20, 1899.

action of which we are able to destroy, a specific against pneumonia." The action of the material was tried in six patients suffering with pneumonia, and in every case there was a considerable reduction of temperature, pulse, and respiration. The effect was manifested in from six to twelve hours, and in two cases the temperature remained normal, while in the remaining cases it rose at the end of six hours. In several cases treated by other observers an improvement followed the use of this method. In other cases failure has resulted. In one case of pneumonia following influenza, Fourrière derived benefit from the injection of 11 c.cm. (or f℥iij) of goat's blood, the operation being repeated four days later, the blood presumably acting by virtue of the bactericidal quality of its serum.

An **antipneumococcic serum** now in the market is obtained by injecting living cultures of the pneumococcus into the veins of a horse, and, when immunity has become established, separating the serum from the recently-drawn blood of the animal, and, after the addition of a small amount of preservative (tricresol), it is sealed up in small flasks. This remedy is used by hypodermic injection (dose, 10 to 20 c.cm., or f℥ii $^{3}/_{4}$-v) in cases of acute croupous pneumonia. The results reported by Dr. James C. Wilson[1] were not very encouraging, affording a mortality of 22.2 per cent. against 20 per cent. by other methods; but this is pronounced a tempting field for further investigations in serum-therapy.

Similar experiments have been made, with excellent results, in the treatment of *glanders* in the horse by means om immunized serum, **Mallein**, but have not yet been extended to the human subject. Mallein, as it is called, is now employed principally for diagnostic purposes, but it should not be used when the temperature is above normal. Bernheim has made use of the same principle in the treatment of more than 100 cases of tuberculosis and asserts that the effect was beneficial, and states that in thirty patients the physical signs and symptoms had shown improvement for five months.

Prophylactic and curative inoculations have been recently employed against *typhoid fever*. Fraenkel and Manchot obtained a sterilized liquid from a culture of typhoid bacilli in bouillon, made from the thymus gland of a calf. They employed it clinically upon fifty-seven cases of typhoid fever, administering 0.5 c.cm. (or *m*viiss) of the sterilized fluid by deep injection into the buttock, without unfavorable local or general effects. The next day 1 c.cm. (or *m*xv) was similarly injected into the buttock of the other side. In the majority of cases the second injection produced chilly sensations, elevation of temperature, followed by a decided fall. The injections were given every other day, with amelioration of symptoms and early defervescence. Klemperer and Levy subsequently injected similar bouillon cultures of typhoid bacilli into dogs and obtained a blood-serum capable of immunizing susceptible animals and of treating the disease, after infection.

In South Africa this preventive antityphoid inoculation was carried on in officers and men, during the siege of Ladysmith, of which Dr. A. E. Wright[2] gives some statistics, in tabular form. He states that while it is at this stage impossible to determine precisely that the inoculated were protected, yet the results would appear to be distinctly encouraging, inasmuch as they show that the proportion, on the one hand, of attacks, and, on the

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[1] *Journal of the American Medical Association*, Sept. 8, 1900.
[2] *British Medical Journal*, July 14, 1900.

other hand, of deaths, from typhoid, was seven times smaller in the inoculated than in the uninoculated. Dr. A. Conan Doyle, in a letter from South Africa to the *British Medical Journal,* regrets that inoculation for enteric fever was not made compulsory, and considers this a mistake, which will not be repeated in any subsequent campaign. If it had been made compulsory, the army would have escaped from most of its troubles. The strong impression, based upon experience, is "that, although it is by no means an absolute preventive, it certainly modifies the course of the disease very materially."

Cholera is another infection which it is sought to control by injection or vaccination with products derived from the cholera bacillus. Professor Klebs has separated from cultures a material which he terms anticholerin: a clear, brownish-yellow viscid liquid, which has been purified by removal of products deleterious to the animal organism. Anticholerin has no toxic effect upon man, but is thought to antidote the virus of cholera. A trial in a Hamburg hospital, limited to serious cases, is said to have given encouraging results.

M. Haffkine has devised a method of vaccination with matter derived from pure cultures of cholera bacilli, and is now engaged in prosecuting experiments on a large scale in India, with what benefit remains yet to be seen. The theory is now advanced that the bactericidal power of blood-serum resides in the nuclein, the reproductive element of blood-cells, and that the nuclein contained in immunized serum acts by stimulating the organs of sanguification. In response to this stimulation a fresh supply of nuclein is given to the blood.

In *syphilis* the serum of the lamb and of the ox has been injected into infected subjects, in a number of cases, by Italian clinicians, and the symptoms of the malady have undergone decided improvement. The quantity employed was about 6 c.cm. (or f℥iss), thrown, upon alternate occasions, into the subcutaneous tissue of each buttock. No other medication was used in these experimental cases. Cotterell made use of dog's serum in two cases of recent syphilis. The rash and other manifestations quickly disappeared under the influence of the injection. Some observers have thought that improvement followed the injection of dog's serum in pulmonary tuberculosis and neurasthenia. The serum of the dog was experimentally employed by Tommasoli in three cases of lupus. The method, however, proved of doubtful utility. Though the lesions were favorably modified, especially in one case, the disease took on fresh activity at the end of a month. The subject deserves continued investigation. It is possible that the blood of animals insusceptible to syphilis may have an antagonistic action to the virus of that disease.

A report upon the properties and uses of **Nuclein** has been made by Germain Sée. It is obtained from the nuclei of vegetable cells, the pulp of the spleen, and yelk of egg. It is distinguished from other albumins or proteids by the presence of phosphoric acid. Nuclein is a colorless or yellowish powder, insoluble in water and alcohol, but soluble, after long boiling, in weak alkaline solutions and in water. It is given in the daily dose of 2 to 3 Gm. (or gr. xxx-xlv), and causes a considerable increase in the number of white corpuscles. Presumably for this reason it is efficacious in pleurisy, pneumonia, and other infectious diseases. Nuclein is thought to be possessed of diagnostic value in latent tuberculosis, producing a transient fever, with

congestion of the apices. The action of nuclein upon micro-organisms has been studied by Dr. Victor C. Vaughan, who, by its use, succeeded in curing guinea-pigs suffering with tuberculosis produced by inoculation. This investigator also states that the injection of nuclein into guinea-pigs renders them immune to pneumonia. The same method of therapy has been applied to tuberculosis in the human subject, with very encouraging results.

Adamkiewicz has endeavored to arrest the progress of carcinoma by injection of a substance which he calls **Cancroin** and which is a product of the living cancer-cell. In respect to chemical composition, cancroin is identical with or closely related to neurin. As prepared, cancroin is an aqueous solution of neurin, to which carbolic and citric acids have been added. Blood-serum or toxins from horses inoculated with erysipelas have lately been used by parenchymatous injection in carcinoma. The meager reports are conflicting. A serum antidotal to streptococcic infection has been administered subcutaneously by Roger, with reported favorable results in several cases of puerperal fever, erysipelas, and suppurative tonsillitis. Anti-streptococcic serum brought out by Marmorek as a remedy for scarlet and suppurating diseases has been used by Baginsky in scarlatina, who found that it is not a specific in the sense that antitoxin is against diphtheria. Louis Fischer has reported unfavorable experiences with this agent.

Sarcoma has been successfully treated by Coley, of New York, by an original method. The following are his directions for use of the combined toxic products of erysipelas and prodigiosus: Inject dose every day into the tumor, or in its neighborhood if inaccessible, aiming to get a rise of temperature to 102° to 104° F. Begin with 0.03 c.cm. (or *m*ss) and increase dose as required. If the patient shows little or no reaction, the dose can be increased beyond 0.5 c.cm. (or *m*viij) without danger. If too great depression follows the injections, they may be given at longer intervals: two days or more. Shake the bottle before using, and keep well stoppered in a cool, dark place,—on ice is best. The needle of the hypodermic syringe should be passed through an alcohol-flame before and after using. After removing stopper place sterilized needle of the hypodermic syringe into the bottle and withdraw enough, or a little more than enough, for the required dose, and quickly close the bottle. For first few doses, up to 0.18 or 0.24 c.cm. (or *m*iii or iv); dilute with boiled water.

Antivenene is a curative serum obtained from a horse which has been immunized against snake-venom. According to Dr. Joseph McFarland, it is a very efficient antidote against the poison of venomous snakes. In the *International Medical Magazine*, September, 1900, he gives the results of experiments upon animals, and demonstrates the protective value of antivenene. The following is the treatment to be pursued when a patient has been bitten by a poisonous snake: 1. Immediately stop the circulation in the bitten part of the body, so as to prevent absorption of the poison. 2. Incise and enlarge the fang-wound and extract the poison by suction (preferably by a cupping-glass, or with the mouth, if the mucous membrane of lips is sound). 3. Inject hypodermically 0.18 to 0.37 c.cm. (or *m*iii-vj) of a fresh 10-per-cent. aqueous solution of calcium chloride into about a dozen places around the wound. 4. Give strychnine hypodermically to stimulate the respiratory centre. Whisky should not be given at all, or only in very small doses, because an excess of alcohol still further depresses the heart already depressed by the venom. 5. Immediately inject 10 to 20 c.cm. (or

3ii $^{2}/_{3}$-vss) of antivenomous serum, and repeat the injection frequently. McFarland advises people living or going into regions where there is danger of snake-bites to carry a bottle of antivenomous serum with them. He pronounces permanganate-of-potassium injections of little value. Dr. Louis de Plasse, of New York, claims to have demonstrated the curative effects for Calmette's **Antivenene** in rattlesnake-bite.

ANIODOL.—M. Sedan, of Marseilles, has recently introduced an antiferment under this name, for which he claims remarkable power as a safe and always reliable antiseptic and an excellent deodorizer, even the most fetid cancerous or gangrenous wounds becoming odorless. This new product is a solution of trimethanal. In a solution of 1 to 100 it destroys, within five minutes, nearly all microbes; in the strength of 1 to 10,000 or even 1 to 20,000 it sterilizes any culture whatever. The exact bactericidal proportion has been fixed by M. Mérieux, director of the Pasteur Institute at Lyons, at 1 to 5600; but numerous experiments prove that the tubercle bacilli, contained in saliva, are destroyed in six hours by a solution of 1 to 500, which is a very satisfactory result.

It is necessary to understand the action of the strength solution used; doses that are too strong will sterilize a wound, but will dry it and prevent cicatrizing. A moderate dose, 1-4000 to 1-3600, on the contrary, favors healing. For the nostrils or mouth, a solution at 1 to 15,000, at the least, and 1 to 3000, at the strongest, produce complete disinfection. For disinfecting the hands and surgical instruments, a proportion of 1 to 2000 generally suffices.

ANISUM (U. S. P.).—**Anise.**

ANISI FRUCTUS (B. P.).—**Anise-fruit.**
Dose, 0.60 to 1.30 Gm. (or gr. x-xx).

Preparations.

Oleum Anisi (U. S. P., B. P.).—Oil of Anise. Dose, 0.30 to 0.60 c.cm. (or *m*v-x).

Aqua Anisi (U. S. P., B. P.).—Anise-water (oil, 2 parts per 1000). B. P., distilled from fruit.

Spiritus Anisi (U. S. P., B. P.).—Spirit of Anise (10 per cent.). Dose, 4 to 7.5 c.cm. (or f3i-ij). B. P., 0.30 to 1.20 c.cm. (or *m*v-xx).

Anise also enters into the U. S. P. official spiritus aurantii compositus, elixir aromaticus, and tinctura opii camphorata.

Anise, or sweet cumin, is the dried, ripe fruit of the Pimpinella anisum (Umbelliferæ). The physiological effects are due to its volatile oil, which is also found in star-anise (Illicium verum). It is carminative, and, having an agreeable odor and taste, is much used, in sweetened infusion, in treating flatulent colic in infants. Anise may be used in the form of hot, sweetened infusion; or given combined with other agents, as in the following:—

℞ Magnesii carb.	2	60 Gm. or gr. xl.
Spt. chloroformi		30 c.cm. or *m*v.
Syrup. simplicis	7	5 c.cm. or f3ij.
Aquæ anisi q. s. ad	30	c.cm. or f℥ij.

M. Sig.: A teaspoonful, for a child under one year, every hour.

In bronchial catarrh, anise is expectorant and slightly sedative, and is therefore used in cough-mixtures. It has likewise been regarded as possessing the power to stimulate the secretion of milk, but without much ground.

ANTHEMIS (U. S. P.).—**Chamomile.**

ANTHEMIDIS FLORES (B. P.).—**Chamomile-flowers.**

Preparations.

Extractum Anthemidis (B. P.).—Extract of Chamomile. Dose, 0.13 to 0.50 Gm. (or gr. ii-viij).

Oleum Anthemidis (B. P.).—Oil of Chamomile. Dose, 0.03 to 0.18 c.cm. (or *m*ss-iij).

The dried flower-heads of Anthemis nobilis (Compositæ) collected from cultivated plants. The British Pharmacopœia requires that the flowers should be expanded before being collected. The oil has a powerful lowering action upon the reflex excitability of the spinal cord. The hot infusion acts as an emetic when freely used. In smaller quantity it is aromatic and carminative, and favors perspiration and the action of the kidneys. It checks reflex cough. A very good combination after a severe cold, in simple fever, and often in acute rheumatism, is prepared by pouring 473 c.cm. (or 1 pint) of boiling water over 31 Gm. (or ℥j) each of chamomile-flowers and the leaves and flowering tops of boneset. The patient should drink about one-half, hot, on retiring, as a diaphoretic, or the entire pint, should emesis be desired. A very excellent prescription for flatulence, and especially flatulent colic in children, is:—

℞ Infus. anthemidis,
Mist. sodæ menth. ..... aa 90| c.cm. or f℥iij.
M. Sig.: From one-half to two tablespoonfuls when necessary.

Locally, a chamomile cataplasm may be used when heat and moisture, with some sedative action, are desired. The recent infusion is employed either hot or cold in domestic practice, in the treatment of colds, bronchitis, and intestinal disorders, or dyspepsia. The oil has been proposed as an antidote in strychnine poisoning, and is useful in spasmodic asthma. The oil of chamomile, on account of its sedative action, is a very good addition to fatty preparations for various inflammations of the skin. Used in the ointments named, it will prove of value:—

℞ Ol. anthemidis ..... |30 to |60 c.cm. or *m*v vel x.
Bismuth. subnit. ..... 4| Gm. or ℥j.
Ungt. zinci oxidi ..... 31| Gm. or ℥j.
M. Sig.: Apply well over the surface for erysipelas, acute eczema, and erythema.

℞ Ol. anthemidis ..... |37 to |75 c.cm. or *m*vi vel xij.
Hydrarg. chlor. mitis ..... |65 Gm. or gr. x.
Ol. eucalypti ..... |30 c.cm. or *m*v.
Adipis lanæ hydrosi..... 31| Gm. or ℥j.
M. Sig.: Use upon old muslin, and apply to the surface in infantile eczema and in seborrhœa.

ANTHRAROBINUM.—**Anthrarobin** is a yellowish powder, not soluble in acids or water, but soluble in alkalies, glycerin, and alcohol. Anthrarobin is related to chrysarobin, for which it is a useful substitute as an application in skin diseases. It produces less irritation and staining than chrysarobin, and is said to have no toxic effects. Antharobin is excreted, for the most part, by the urine unchanged, though some of it is oxidized to form alizarin. It colors the skin yellow and the hair red. In psoriasis, tinea versicolor, and

herpes it is used in 10-per-cent. ointment or alcoholic solution, which should be made fresh at least every week.

Anthrarobin can be prescribed thus, with advantage:—

℞ Anthrarobini	4	Gm. or ʒj.
Ungt. hydrarg. nitratis	2	Gm. or ʒss.
Ungt. zinci oxidi	31	Gm. or ʒj.—M.

For chronic eczema and psoriasis.

℞ Anthrarobini	4	Gm. or ʒj.
Ungt. hydrarg. oleatis (10 per cent.)	31	Gm. or ʒj.—M.

Use in tinea versicolor, as well as in ringworm and favus.

Hydroxylamin Hydrochloride (NH_2OHHCl), a substance allied to anthrarobin and chrysarobin, occurs in the form of colorless, hygroscopic crystals, soluble in water, alcohol, and glycerin. It has the advantage of not staining the skin, but is highly irritant and is capable of producing toxæmia. It has been used in psoriasis, lupus, scabies, and vegetable parasitic diseases. Hydroxylamin hydrochloride should not be applied, to begin with, in greater strength than $^1/_{10}$ of 1 per cent. dissolved in equal parts of alcohol and glycerin. The proportion may be gradually increased within the limits of tolerance. This compound is not adapted to internal use. It is employed chiefly in photography as a developer.

ANTIMONIUM.—Antimony.

U. S. P. Preparations.

Antimonii et Potassii Tartras.—Antimony and Potassium Tartrate, Tartar Emetic. Dose, 0.0016 to 0.065 Gm. (or gr. $^1/_{40}$-j).

Vinum Antimonii.—Antimonial Wine (contains about 4 Gm. tartar emetic to each 1000 c.cm., or 0.13 Gm., or gr. ij, in each 30 c.cm., or fʒj). Dose, 0.12 to 2 c.cm. (or *m*ii-xxx), as an expectorant, or 4 to 8 c.cm. (ʒi-ij) as an emetic for adults.

Tartar emetic also enters into syrupus scillæ compositus (U. S. P.). Mistura glycyrrhizæ composita (U. S. P.), or brown mixture, contains antimonial wine, 6 parts in 100, or of tartar emetic, about 0.008 Gm. in 30 c.cm. (or gr. $^1/_8$ per ounce).

B. P. Preparations.

Antimonium Tartaratum.—Tartarated Antimony, Tartar Emetic. Dose, as a diaphoretic, 0.0027 to 0.008 Gm. (or gr. $^1/_{24}$-$^1/_8$); as an emetic, 0.065 to 0.13 Gm. (or gr. i-ij).

Antimonii Oxidum.—Antimonious Oxide. Dose, 0.065 to 0.13 Gm. (or gr. i-ij).

Antimonii Nigrum Purificatum.—Antimonious Sulphide (for pharmaceutical purposes).

Antimonium Sulphuratum.—Sulphurated Antimony (a mixture containing antimonous sulphide and oxide, antimonic sulphide and oxide, and sulphur). Dose, 0.065 to 0.13 Gm. (or gr. i-ij).

Pulvis Antimonialis.—Antimonial Powder. Dose, 0.20 to 0.38 Gm. (or gr. iii-vj).

Pilula Hydrargyri Subchloridi Composita.—Compound Pill of Mercurous Chloride, Plummer's Pill. Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Vinum Antimoniale.—Antimonial Wine. Dose, 0.60 to 2 c.cm. (or *m*x-xxx); as an emetic, 4 to 8 c.cm. (or fʒi-ij) to adults.

Pharmacology.—Antimonium and potassium tartrate, or tartarated antimony ($2K[SbO]C_4H_4O_6 + H_2O$), is in colorless, transparent crystals, which "should contain not less than 99.5 per cent. of pure antimonium and potassium tartrate, and should be kept in well-stoppered bottles" (U. S. P.). It is a powerful irritant, and, applied to the mucous membranes, causes vesication. To the skin it gives a sensation of burning, with redness, followed by a pustular eruption, resembling small-pox, and deep

ulcers, which are slow in healing. When swallowed, it is a depressing emetic, also causing an increase of the secretions of the intestinal tract, with occasional diarrhœa. It has a powerful diaphoretic action, and is eliminated by the bile, milk, sweat, urine, and the intestinal secretions. Upon the circulation it is depressing; under its influence the heart's action becomes weak and irregular, and the arterial tension is lowered. The pulsations are likewise retarded. The depression of the vasomotor system is both centric and peripheral. Respiration becomes slower and the bronchial secretions are increased. The brain is not directly affected, except that under certain conditions tartar emetic exerts a sedative action, especially when combined with opium. Large doses diminish reflex excitability of the spinal cord, and may produce both motor and sensor paralysis. A special action has been noticed upon the liver, the waste of nitrogenous elements being increased, with diminished oxidation of the non-nitrogenous elements. Excessive doses have a toxic effect upon motor nerves and muscles. The rate of absorption from the stomach and intestines is slow, and the rate of elimination by all the channels of excretion is also slow.

Toxicology.—Poisonous doses of tartar emetic (0.065 Gm., or gr. j, or more), cause vomiting, with burning pain at the epigastrium, severe colic, purging, and small, frequent pulse and early collapse, with much prostration of muscular system, rapidly occur. Respiration is shallow, and, as in cholera, the patient suffers from cramping pain in the calves of the legs. In some cases furious delirium has occurred. Death is usually preceded by stupor or convulsions. Toward the close of the case the urine may become bloody and scanty or may be suppressed. In some instances vomiting is absent and there is profound nervous prostration. Repeated small doses of tartar emetic may occasion a chronic intoxication, evidenced by nausea, purgation, a small, frequent pulse, and, finally, death from exhaustion. In this class of cases suspicion should be aroused that the drug has been administered for criminal purposes. Absorption and elimination are rapid. The drug is eliminated by the mucous membrane of the stomach and bowels, but especially by the kidney. Death may result from exhaustion, or from resulting gastro-intestinal inflammation. The antidote is tannic acid, which renders the salt insoluble, to be followed by demulcents and anodynes to relieve the pain. Depression is counteracted by alcohol and digitalis. Tartar emetic is incompatible with acids, alkalies, and drugs containing tannic acid. Infusions of coffee and tea are, therefore, both physiological and chemical antidotes to tartar emetic, and may be used to irrigate the stomach. The body should be kept warm by hot-water bags, and cardiac and respiratory stimulants given rather freely. Chronic poisoning produces constant nausea and entire anorexia, with subnormal temperature, moist, clammy skin, diarrhœa, and, finally, death from exhaustion.

Therapy.—Tartar-emetic ointment is a powerful counter-irritant, but is seldom used on account of the danger of producing sloughing and scars. The treatment of inflammation by tartar emetic in large doses has been abandoned, but fractional doses (0.0016 Gm., or gr. $^1/_{40}$) alone or in combination with Dover's powder (0.13 Gm., or gr. ij) and nitre (0.20 Gm., or gr. iij) have proved very servicable in sthenic pneumonia and in pleurisy. In bronchial inflammation with deficient secretion the wine of antimony, or compound syrup of squills, is frequently given. Dr. I. G. Davis writes with approval of the action of the golden sulphuret of antimony in chronic bron-

chitis. He administers it in doses of 0.0012 to 0.002 Gm. (or gr. $^1/_{50}$-$^1/_{30}$) triturated with sugar of milk.

Tartar emetic should not be given in croup (especially diphtheritic), as it is too depressing. For bronchitis in children, Ringer advises a solution of 0.065 Gm. (or gr. j) to 473 c.cm. (or Oj) of water, of which a teaspoonful is to be given every quarter- or half- hour. Tartar emetic should rarely, if ever, be administered to infants or very young children.

Small doses of tartar emetic have also been recommended in orchitis, mammitis, tonsillitis, parotiditis, muscular rheumatism, and spasmodic asthma. A combination of tartar emetic and opium is very serviceable in the furious delirium which attends some cases of typhoid and typhus fevers. A similar condition in delirium tremens is relieved by the same treatment, which has also been used with success in puerperal mania. Ringer states that chorea is sometimes benefited by tartar emetic given in doses sufficient to produce vomiting, once or twice a day. Administered in the same manner, it has been found capable of relieving rebellious cases of lumbago and muscular rheumatism. In acute gonorrhœa Surgeon-Major Lawrie regards 1 c.cm. (or *m*xv) of antimonial wine, given every second hour, as an excellent remedy.

In some skin diseases—as chronic eczema, psoriasis, and other scaly disorders—the use of tartar emetic, or the oxide, or sulphurated antimony, in small doses, and frequently repeated, is of much service.

The so-called tolerance of antimony was due to the fact that after the vitality of the system became lowered by its action, comparatively large doses could be swallowed without producing vomiting.

ANTINERVIN (**Salicylanilid-bromacetanilid**) is a proprietary combination of acetanilid, salicylic acid, and bromine, with the formula $C_5H_5NH[C_6H_4(OH)(CO)] + C_6H_4Br.NH.CH_3CO$, according to its introducer, Dr. S. Radlauer, of Berlin. It is a white, crystalline, granular powder, without odor, and almost tasteless. This substance is soluble in alcohol, dilute alcohol, and hot water, and almost insoluble in cold water; it is more soluble in water slightly acidulated with hydrochloric acid or in dilute solution of caustic potassa. The dose is 0.32 to 0.50 Gm. (or gr. v-viij).

Physiological Action and Therapy.—Its physiological action is similar to that of other remedies of this class: it is antiseptic, antipyretic, and hypnotic. It resembles antipyrin in its effects upon the sensory nerves and has been used clinically (1) to relieve pain; (2) to produce sleep; (3) to allay spasmodic cough; (4) to reduce fever; (5) to arrest fermentation in infectious dyspepsia. In the small doses usually given (0.32 to 0.50 Gm., or gr. v-viij), it relieves headache and restlessness and produces natural sleep. In the treatment of influenza, or grippe, this drug reduces the fever and allays pain and restlessness. Where cough becomes spasmodic and paroxysmal, antinervin exercises a sedative effect and produces sleep. It is of advantage in whooping-cough (0.065 to 0.13 Gm., or gr. i-ij, every two hours) or in asthma, whether of cardiac or bronchial origin. It has been used in Germany, with alleged success, in diabetes, reducing both the sugar and the amount of urine; and it is stated to be particularly serviceable in acute articular rheumatism. Dr. Ludwig Sior, of Darmstadt, ascertained that when antinervin was given in 1 Gm. (or gr. xv) doses at hourly intervals for three hours, beginning about noon, it exercised a decided influence in

reducing temperature. The minimum temperature was generally reached from six to nine hours after the administration of the first dose. About twelve hours from the same period the temperature began gradually to ascend. The reduction of temperature was not accompanied by unpleasant manifestations. As a rule, copious perspiration and, frequently, a sleep of several hours were produced. In acute rheumatism its action was equal to that of sodium salicylate. It was beneficial in trifacial neuralgia, migraine, the pain of transverse myelitis, and in headache from various causes. As an analgesic it was usually given in doses of 1 Gm. (or gr. xv), repeated, when needed, twice during the day. In the cases where it was used no deleterious effects upon the heart or nervous system were detected.

ANTIPYRINA (U. S. P.).—**Antipyrine.** Same as **PHENAZONUM** (B. P.). (See **Phenazonum.**)

APOCYNUM (U. S. P.).—**Apocynum (Canadian Hemp).**

Preparation.

Fluidextractum Apocyni (U. S. P.).—Fluidextract of Apocynum. Dose, 0.30 to 1.20 c.cm. (or *m*v-xx). (100 per cent.)

Pharmacology and Therapy.—The dried rhizome and roots of Apocynum Cannabinum, or of closely allied species of Apocynum (Apocynaceæ), contains the bitter, resin-like glucosides, **Apocynin** and **Apocynein,** the former soluble in alcohol, the latter in water. These principles in small doses act upon the circulation, like strophanthus, as a tonic. In larger amounts they are emetic, cathartic, and diuretic.

Apocynum usually, but not constantly, increases arterial tension. It acts as a diuretic without irritating the renal epithelium. It is probable that the emetic and cathartic effects of this drug are due to apocynein and its diuretic virtue to apocynin. The decoction of apocynum is irritant to the stomach and bowels, but the tincture is free from this disadvantage. The tincture (1 to 10) has been employed in the daily doses of 4 to 6 c.cm. (or *m*lx-xc). A decoction has been used in the dose of 30 to 60 c.cm. (or f℥i-ij) in the treatment of dropsy, but the fluid extract is more reliable.

Dr. W. T. Richmond regards apocynum as of value in the treatment of ascites, Bright's disease with or without dropsy, and valvular heart disease with general anasarca. He employs the fluid extract, beginning with 7 or 8 drops, and gradually increasing till the desired effect is obtained. Toleration is established by continued use, and the dose must therefore be raised from time to time. Dr. Richmond has also seen it of service in jaundice. In the dose of 0.015 to 0.03 Gm. (or gr. $^1/_4$-$^1/_2$) apocynin has been used as an expectorant.

Dr. J. Glinski has found that apocynum relieves the functional disturbances which accompany organic heart disease and diminishes the area of dullness in dilatation. The drug seems to have no cumulative effect.

APOMORPHINÆ HYDROCHLORIDUM (U. S. P., B. P.).—**Apomorphine Hydrochloride** ($C_{17}H_{17}NO_2HCl$).

Dose, 0.003 to 0.006 Gm. (or gr. $^1/_{20}$-$^1/_{10}$) by hypodermic injection. By the mouth 0.006 to 0.015 Gm. (or gr. $^1/_{10}$-$^1/_4$).

Pharmacology and Therapy.—Apomorphine is an artificial alkaloid prepared from morphine or codeine by pure hydrochloric acid, 20 parts of

the latter being added to 1 part of the former, in a strong glass tube, and exposed to a high temperature. Apomorphine hydrochloride occurs in the form of colorless or grayish-white crystals, soluble in water and alcohol, almost insoluble in ether or chloroform.

According to the investigations of Reichert, toxic quantities of apomorphine give rise to convulsions followed by paralysis, chiefly of spinal origin. Even when given in ordinary medicinal amounts extreme prostration and uncontrollable vomiting may follow, with weak, thready pulse and low arterial pressure. Poisonous doses cause rapid and irregular respiration. Apomorphine hydrochloride is a systemic emetic and can be used hypodermically in the dose of 0.008 Gm. (or gr. $^1/_8$) to empty the stomach. In smaller doses it can be given as an expectorant in bronchitis. It is of value in the treatment of dry, hacking cough, attended with little or no secretion. As the result of a series of clinical experiments, Murrell[1] has ascertained that apomorphine, given by the mouth, is tolerated in much larger doses than had been supposed. He was able to administer 0.065, 0.10, or 0.13 Gm. (gr. i, iss, or ij) thrice daily without exciting nausea. In these quantities he found apomorphine hydrochloride an excellent expectorant in chronic bronchitis, bronchorrhœa, and emphysema. Murrell usually prescribes the apomorphine in syrup of wild cherry, of tar, or of lemon. The addition of a few drops of nitrohydrochloric acid to the mixture is advantageous. The same observer has employed apomorphine as a spray with very satisfactory results. He has frequently given as much as 2 c.cm. (or f℥ss) of a 1-per-cent. solution in a little water for each inhalation. A combination of apomorphine and morphine is valuable, and has been employed by Rossbach in phthisis. The cough becomes less frequent and the sputum more fluid.

Apomorphine hydrochloride is often serviceable in the treatment of asthma, the writer prescribing it thus:—

℞ Apomorphinæ hydrochloridi	13	Gm. or gr. ij.
Acid. hydrochloric. dilut.	6	c.cm. or f℥iss.
Morphinæ hydrochloridi	065	Gm. or gr. j.
Syr. tolutani	30	c.cm. or f℥j.
Aq. chloroformi q. s. ad	240	c.cm. or f℥viij.

M. Sig.: Fifteen cubic centimetres, or half an ounce, every third hour until dyspnœa is relieved.

Digitalis or strophanthus may be combined with the above if there is any cardiac debility.

Apomorphine should not be continued too long, as it is liable to produce pulmonary œdema.

Dr. Alexander F. Samuels has written of the value of apomorphine in spasmodic croup, giving 0.0013 Gm. (or gr. $^1/_{48}$) every five or ten minutes until vomiting is produced. If the child is unable to swallow, the remedy may be introduced beneath the skin. J. S. Horsley has found this alkaloid of service in controlling convulsions. He successfully employed hypodermic injections of 0.004 to 0.006 Gm. (or gr. $^1/_{15}$-$^1/_{10}$) in a case of strychnine poisoning. This writer recommends apomorphine in the treatment of convulsions and minor phenomena of hysteria. In hypodermic doses of 0.002 Gm. (or gr. $^1/_{30}$) apomorphine hydrochloride is a valuable sedative and hypnotic

[1] "On the Action of Apomorphine and Apocodeine, with Reference to their Value as Expectorants in the Treatment of Chronic Bronchitis," by William Murrell, M.D., F.R.C.P., in the *Medical Bulletin*, March, 1891.

in cases of insomnia, delirium tremens, and morphinism. The first dose should be not more than half the above, in order to test the tolerance of the patient. Vomiting always indicates too large a dose. There is no danger of a drug habit being acquired. The remedy may also be used in maniacal delirium, hystero-epilepsy, chorea, and persistent hiccough. It has been administered to produce relaxation of a rigid os uteri. Apomorphine may also be administered, in combination with strychnine, by the mouth. Paul E. Bechet, of New Orleans, gives 0.002 Gm. (or gr. $^1/_{30}$) of each of these, at three-hour intervals, in delirium ebriosum, or acute alcoholism.

AQUA (U. S. P.).—**Water** (H_2O).
Potable water in its purest attainable state.

AQUA DESTILLATA (U. S. P., B. P.).—**Distilled Water.**
A colorless limpid liquid, without odor or taste, and perfectly neutral to litmus-paper.

AQUA HYDROGENII DIOXIDI (U. S. P.), **LIQUOR HYDROGENII PEROXIDI** (B. P.).—Solution of hydrogen dioxide. (See **Barii Dioxidum.**)

ARASA is a native of Brazil and Uruguay. The portion used is the bark of the root. It is employed in South America in cases of metrorrhagia, 2 Gm. (or 3ss) of the bark being boiled in a cupful of water and administered for several days before and during the menstrual period. The taste is said to resemble that of cascarilla, and no unpleasant secondary effects have been observed.

ARECA.—**Areca,** or **Betel nut,** is the seed of Areca Catechu (Palmaceæ). E. Johns found three alkaloids in areca-nut: **Arecoline, Arecaine,** and **Guvacine.** Another, called **Arecaidine,** is an isomer of arecaine. Arecoline is methyl-arecaidine, and is convertible into arecaidine and the latter into arecoline. It also contains tannic and gallic acids. Arecaine is a crystalline body, soluble in water, insoluble in alcohol, ether, and chloroform. Areca-nut is a powerful tæniacide and poison. The alkaloid arecaine slows the heart and respiration, and purges by increasing intestinal peristalsis. Powdered areca has for a long time been used as a tæniacide in veterinary practice. More recently this remedy has been used for the same purpose in the human subject. Dose, 0.32 to 1.30 Gm., or gr. v-xx (4 to 8 Gm., or 5i-ij, as a vermifuge). The fluid extract is the best preparation. Its administration should be preceded and followed by a purgative like castor-oil. Betel-nut is believed also to increase the secretions from the salivary glands, and has a slightly stimulating effect upon the cerebral centres. Large doses may cause tetanic convulsions. Death is caused by respiratory failure.

Arecoline hydrobromide is a myotic. When applied in $^1/_2$-per-cent. watery solution, it causes a slight stinging sensation for a few moments, but leaves no conjunctival or ciliary congestion. Chetwood-Aiken[1] considers it superior to eserine in the treatment of glaucoma. Its action is more rapid and more powerful, but its effect is of shorter duration, and is devoid of the headache and other unpleasant after-effects so often noted with eserine.

Lavagna[2] describes the action of **arecoline,** a drug extracted from the

[1] *British Medical Journal,* Jan. 14, 1899.

[2] *Giornale della R. Academia di Medicina di Forma,* 1895, Nos. 3 and 4.

nut of the Italian areca tree. Fróhner found some time ago that arecoline is the best sialagogue, being superior to pilocarpine, and that it equals eserine as a laxative.

Dr. Lavagna has observed that the instillation of a drop of a 1-per-cent. solution of the hydrobromide into the conjunctival sac causes a sensation of warmth, and afterward some lachrymation and spasm of the eyelids. The irritation lasts scarcely more than a minute, and is followed by slight hyperæmia of the conjunctiva and subcorneal injection, which disappear after some minutes. After 2 minutes, violent clonic spasms of the iris are produced and there is distinct diminution of the pupillary space. The myosis is very noticeable after 5 minutes, and reaches its maximum in 10 minutes. This maximum is maintained for 25 to 30 minutes, after which the pupil begins to enlarge, and becomes normal once more after about 70 minutes. At the end of 90 minutes the pupil is about one-half millimetre larger than normal. Dr. Lavagna has not noticed any modifications in intra-ocular tension due to the drug. Before acting on the iris, arecoline causes a spasm of the ciliary muscle, which gives rise to increased refraction in the eye for the time being.

ARGENTUM.—Silver.

Preparations.

Argenti Cyanidum (U. S. P.).—Silver Cyanide. Dose, 0.0016 to 0.003 Gm. (or gr. $^1/_{40}$-$^1/_{20}$). (Should contain not less than 99.9 per cent. of pure silver cyanide.)

Argenti Nitras Fusus (U. S. P.).—Molded Silver Nitrate, Lunar Caustic. Argenti Nitras Induratus (B. P.).—Toughened Caustic (95 to 5). External use.

Argenti Nitras Dilutus (U. S. P.).—Diluted Silver Nitrate (silver nitrate, 1 part; and potassium nitrate, 2 parts). Argenti Nitras Mitigatus (B. P.).—Mitigated Caustic. External use.

Argenti Nitras (U. S. P., B. P.).—Silver Nitrate. Dose, 0.01 to 0.03 Gm. (or gr. $^1/_6$-$^1/_2$). Crystallised.

Argenti Oxidum (U. S. P., B. P.).—Silver Oxide. Dose, 0.03 to 0.13 Gm. (or gr. ss-ij).

Pharmacology.—Metallic silver is a white metal taking a high polish, and not easily affected by acids or by oxygen, although readily tarnished by sulphur. It is official only in the form of salts, of which the nitrate is most largely used. Silver nitrate is an anhydrous salt which crystallizes in colorless, rhombic plates. It is readily soluble in cold water, and has a metallic, styptic taste. Upon the addition of hydrochloric acid or a soluble chloride to a solution of the nitrate, a white, curdy precipitate is formed. This precipitate is wholly soluble in ammonia. The crystals, fused and cast in molds, present the form of round, grayish sticks. The cyanide is convenient for the extemporaneous preparation of hydrocyanic acid, which is obtainable by adding an excess of some mineral acid to the solution containing this salt. Metallic silver is used in surgery in the form of silver wire for sutures and for making cannulæ for tracheotomy, catheters, etc.

Physiological Action.—Silver nitrate, in weak solutions, acts as an astringent, and, in substance, coagulates the albumin of the tissues and destroys their vitality, acting as a caustic. The mitigated stick of lunar caustic is mild and superficial in its action; the pure nitrate may cause sloughing or ulceration. One objection to its use is the discoloration it leaves behind, the skin becoming black after exposure to the light. (When the physician's fingers are stained with nitrate of silver in making an application, the color

may be removed by washing with a solution of cyanide of potassium. According to Hahn, the stains may be removed from the skin or clothing also by a solution containing 5 Gm. (or gr. lxxv) each of corrosive sublimate and ammonium chloride in 37 c.cm. (or f3x) of distilled water.) Local applications of silver nitrate whiten mucous membrane. When swallowed, symptoms of irritant poisoning appear, with pain, distress, and vomiting. Common salt is the antidote, and vomiting should be encouraged by administering warm salt water; after cleansing the stomach the bowels should be purged by oil. When any of the silver salts (but especially the nitrate) has been taken for a length of time, a slate-colored line appears along the gums and there is darkening of the conjunctiva, and soon afterward the entire surface of the body becomes dingy or slate-colored, due to the deposit of metallic silver in the pigment-layer of the skin and in all the constituents of the skin below the Malpighian layer. This condition is known as **Argyria**, and is permanent. The patient should therefore be carefully observed during the administration of silver, and the remedy from time to time intermitted. Argyria has also resulted from the local use of silver nitrate, as reported by Hutchinson, in the *Annals of Surgery* for April, 1892. In medicinal doses the silver salts act as a tonic to the nervous system and changes occur in the blood; tissue-change is increased; the flow of bile is also increased, and in larger doses there is embarrassment of the respiration, depression of the circulation, and reduction of temperature. Tetanic convulsions or paralysis may be produced by overdoses, the paralysis being of central origin.

Therapy.—Silver foil, or metallic silver in very thin sheets, is employed as a surgical dressing for wounds. At Johns Hopkins Hospital the practice originated of applying silver-leaf dressings for burns, the lesion being simply covered with the leaf without the use of any adhesive material. It is an excellent protective dressing which may be painlessly removed and renewed. It prevents suppuration and is said to reduce shock. In Albany Hospital it has been used as a dressing for laparotomy wounds, the leaf being retained by a gauze compress and bandage. Silver nitrate is used locally in 2-per-cent. solution, dropped into the eyes of newborn infants to prevent purulent conjunctivitis (ophthalmia neonatorum) after the method of Credé. G. E. De Schweinitz[1] has seen marked conjunctivitis neonatorum appear after the employment of Credé's method and has also observed severe cases of conjunctivitis with haziness of the cornea, and one case of persisting conjunctival hæmorrhage, which nearly proved fatal. He insists that Credé's method should be reserved for the eyes of those children who have passed through a birth-canal known to be infected, or from which the suspicion of infection could not be positively eliminated prior to the birth. Whenever infection, or the suspicion of infection, can be excluded, Credé's method is not necessary, milder methods of prophylaxis being sufficient. The mitigated stick is a good application to granular lids, chancroids, small-pox vesicles (in order to prevent pitting), and in general to excite a healthy action of granulating surfaces. In gynæcology, the lunar caustic, in solid form, is used in chronic cervical catarrh and in venereal sores. An application of the solid stick to the scrotum has a good effect in acute epididymitis or orchitis; also along the course of the affected vessels in lymphangitis of the forearm from a poisoned wound of the finger. Thoroughly applied to the

[1] *Philadelphia Medical Journal*, vol. iii, 351.

wound caused by the bite of a rabid animal, it is claimed by Youatt to be a protection against hydrophobia. For chronic nasal catarrh, it may be mixed with gum acacia, pulverized, and blown into the throat or nose. In pharyngitis, tonsillitis, and laryngitis, solutions (made with water or spirit of nitrous ether of 1.30 to 2.60 Gm. to each 30 c.cm., or gr. xx-xl per ounce) are applied with excellent results; Dr. Horace Green advocated the stronger solution applied with a probang to the larynx in diphtheritic croup. In appropriate cases these solutions are valuable in gonorrhœa and urethritis.

An abortive method of treating gonorrhœa has had its advocates, and consists essentially in the injection of a strong solution of silver nitrate during the early stage of the disease. Professor Diday insisted upon the importance of the following points: The strength of the solution should be 1.60 Gm. to 30 c.cm. (or gr. xxiv to f℥j) of distilled water, which, in most cases, will cause but slight pain at the moment of injection; if sharp pain is produced immediately the fluid should not be allowed to remain for more than 15 or 20 seconds; when the pain is moderate it is allowed to remain for 1 or 2 minutes, according to the tolerance. This method has been abandoned on account of the liability of producing sloughing and stricture of the urethra. Better results are now obtained from the employment of the new silver compounds with albumin, casein, or nuclein, which destroy the gonococci, and are less irritant to the mucous membrane.

In erysipelas the disease may sometimes be arrested by delimiting the affected area with silver nitrate. It has also been used with good results in pruritus vulvæ, herpes, eczema, and lichen, when they occur in circumscribed patches. Boils may sometimes be aborted in this way, and a stye on the eye may be checked by an early application. Buboes are treated by Cordier, whether suppuration has occurred or not, by puncture, through which a 2-per-cent. solution of silver nitrate is injected. Recovery is said to be rapid and the formation of an unsightly scar is avoided. After disinfection of the wound, Simmons recommends the injection of a solution of silver nitrate, with a view to preventing the development of tetanus from punctured wounds. The solution which he employs contains 0.65 Gm. to 30 c.cm. (or gr. x to f℥j). Dr. Lazzaro proposes silver fluoride as an efficient local application in anthrax. It is a brown or blackish-brown hygroscopic mass, readily soluble in water, antiseptic, equal in caustic effect to the nitrate, and is destructive to the anthrax bacillus, while harmless to the human organism.

The solid stick nitrate is useful in restraining the bleeding from leech-bites. When, in the course of a chronic illness, bed-sores threaten to form, the local application of a solution containing 1.30 Gm. to 30 c.cm. (or gr. xx to f℥j) of silver nitrate will avert the mischief. Ringer has found the same salt useful in whooping-cough. A solution may be applied to the throat by a mop or sponge, or it may be used in the form of a spray. The latter method, however, is inapplicable to children less than three years of age. The stain produced, moreover, is a serious objection to the spray. A strong solution, or the solid stick, is a good stimulant to indolent ulcers and to ulcer of the rectum. A 2.60 Gm. (or gr. xl) solution in nitrous ether has been used in tinea trichophytosis. A solution containing from 1.30 Gm. (or gr. xx) to 7.5 c.cm. (or f℥ij) to 30 c.cm. (or f℥j) of water may be successfully employed, by injection of small quantities (a few drops) into the sac of an hydrocele or cystic tumor. A sponge probang saturated with a very weak solution of silver nitrate is sometimes of service in spasmodic stricture of the œsophagus.

Applications should be made occasionally, at intervals of several days. In pseudomembranous enteritis it is a good practice, in the intervals of paroxysms, to irrigate the bowel with 0.32 to 0.65 Gm. (or gr. v-x) of silver nitrate in a pint of water. Prolopsed rectum, especially in children, is benefited by cauterization with mitigated silver nitrate.

On account of the staining of the skin, silver nitrate is now little used internally, although it has acknowledged effects upon the nervous system. Caccianiga has collected 60 cases of acute lobar pneumonia in which treatment by silver nitrate seemed to be clearly beneficial. Of the group only 3 died. The dose was from 0.10 Gm. (or gr. iss) in children (eight to ten years) up to 0.25 to 0.32 Gm. (or gr. iv-v) in adults, given in pill or suspension. In cases of urgency, a 0.50-per-cent. solution of protargol was injected hypodermically. Beyond some vomiting, no ill effects were observed from the treatment either by silver nitrate or protargol. The most marked effect of the silver salt was the reduction of the temperature, which began in the first twenty-four hours and was noticed in all the cases. Apyrexia occurred by crisis in 48 cases, by lysis in 12. When small doses were given, apyrexia generally occurred by lysis; with larger doses, by crisis. In the defervescence due to silver, the pulse did not come down at the same time, but later. Silver oxide is said to be less subject to this objection and equally efficient, especially in the early stages of locomotor ataxia and in epilepsy. A double salt, the sodium and silver hyposulphite, has been recommended by Curci and others as efficacious in locomotor ataxia, and free from the disadvantage of staining the skin. It is very soluble in water, does not coagulate albumin, and may be given by the mouth in doses of 0.045 to 0.20 Gm. (or gr. $^{3}/_{4}$-iij), or hypodermically, from 0.01 to 0.045 Gm. (or gr. $^{1}/_{6}$-$^{3}/_{4}$) in the course of the day. In gastralgia, also, the silver salts are sometimes remarkably curative. They have effected improvement, likewise, in chronic gastritis and ulcer of the stomach. The silver nitrate has been successfully given for the purpose of allaying yeasty vomiting. When, in typhoid fever, symptoms of irritation in the alimentary tract become prominent, and peritonitis or hæmorrhage appears imminent, the following prescription was used by William Pepper, in the Philadelphia Hospital:—

℞ Argenti nitratis ..... | 13 Gm. or gr. ij.
Mucilag. acaciæ ..... 60 | c.cm. or f℥ij.

M. Sig.: A teaspoonful three or four times daily, combined with tincture of opium or belladonna, if necessary, for diarrhœa or constipation.

Silver nitrate sometimes yields good results in enteritis or colitis, especially if ulceration is present. Silver nitrate or oxide may also be given as follows:—

℞ Argenti nitratis,
Extracti opii ..... aa | 13 Gm. or gr. ij.

M. et ft. pil. no. viij.
Sig.: A pill every four hours, for gastric ulcer.

℞ Argenti oxidi ..... | 13 Gm. or gr. ij.
Ext. belladonnæ fol. ..... | 065 Gm. or gr. j.
Ext. gentianæ ..... 1 | 30 Gm. or gr. xx.

M. et ft. pil. no. xvj.
Sig.: A pill three times a day.

An efficient prescription for neuralgia and chorea:—

℞ Argenti nitratis	20	Gm. or gr. iij.
Syrup. ipecac.	30	c.cm. or f℥j.
Morphinæ sulphatis	065	Gm. or gr. j.
Mucil. acaciæ	60	c.cm. or f℥ij.

M. Sig.: A teaspoonful in water, three times a day, before meals. Exerts marked influence over chronic diarrhœa, especially of phthisis.

In gastric catarrh, the gastro-intestinal catarrh of phthisis, ulcer of the stomach, or chronic diarrhœa we may combine it as follows:—

℞ Codeinæ	20	Gm. or gr. iij.
Argenti nitrat.	38	Gm. or gr. vj.
Pulv. acaciæ	q. s.	

Div. in pil. no. xij.
Sig.: Give one every two to four hours.

In catarrhal jaundice, silver nitrate has been given in 0.005 Gm. (or gr. $^1/_{12}$) doses with advantage. In pill form the effect is more sustained and the remedy can be given in larger doses than when in solution. When used in affections of the stomach, the remedy is best given half an hour or so before meals, in order that the local effect may be secured. It should not be used for a long period; either in pill or in solution.

Dysentery, with ulceration of the large bowel, is very much benefited by large injections of weak solutions of silver nitrate (0.0075 to 0.015 Gm., or gr. $^1/_8$-$^1/_4$, to 30 c.cm., or f℥j, of mucilage). Bartholow advised the internal use of the nitrate, combined with opium, in addition to the treatment by injections. According to the same writer, both the nitrate and the oxide are useful in nervous dyspepsia, cholera infantum, and jaundice depending upon catarrh of the bile-ducts. Silver is sometimes beneficial in chorea. Silver oxide is occasionally able to check profuse perspiration, and may prove useful in menorrhagia. The nitrate has given relief in obstinate enteralgia.

Dr. Crocq, of Brussels, claims that silver nitrate is a valuable remedy in phthisis, promoting appetite and digestion, diminishing cough, expectoration, and night-sweats. He administers from 0.009 to 0.02 Gm. (or gr. $^1/_7$-$^1/_3$) during the day. Mr. P. A. Brady, forty years ago, regarded this salt as of great value in the treatment of phthisis. He was accustomed to give it in doses of 0.01 Gm. (or gr. $^1/_6$) combined with 0.20 Gm. (or gr. iij) of Dover's powder three times a day. Dr. Thomas Mays, of Philadelphia, reported some remarkable results from hypodermic injections of solutions of silver nitrate in the skin of the neck, over the pneumogastric nerve, in the treatment of phthisis pulmonalis. In some cases, striking benefit was noted.

Various remedies have been proposed for the **Argyria**, or the skin discoloration produced by silver. Unfortunately, none has proved reliable, and in the vast majority of cases the stain proves permanent. It has been claimed that blistering will lighten the color. Dr. Eichmann states that in two cases the color disappeared after the use, four times a week, of potash-and-soap baths. Potassium iodide has been given internally for the same purpose. Argyria is by no means as common now as formerly, since silver is no longer so largely employed in the treatment of epilepsy and locomotor ataxia.

Argentamine is a 10-per-cent. solution of silver phosphate in an aqueous solution of ethylenediamin. This solution is said to contain as much silver as a 10-per-cent. solution of silver nitrate. This new combination is

brought forward as a substitute for the silver nitrate. Argentamine is a permanent, limpid fluid, readily miscible with water, of an alkaline reaction and ammoniacal odor. It does not precipitate albumin, and has a very slight caustic action. The solution is a clear, colorless liquid, and, according to Dr. Schaffer, possesses bactericidal properties which will render it valuable in the treatment of gonorrhœa and diphtheria. In the anterior urethra it should not be used stronger than 1-2000; for the posterior urethra, 1-250. In ophthalmology it has been used in 5-per-cent. strength. It becomes decomposed when left exposed to the light.

Argentum Credé,[1] or soluble metallic silver (colloidal silver), as originally recommended by B. Credé, of Dresden, at the Moscow Congress, is used in medicine as a 10-per-cent. ointment: the unguentum Credé. It is employed by inunction, using 3 Gm. (or gr. xlv) for an adult, or for children 1 Gm. (or gr. xv), especially in septic cases. More recently Credé has used colloidal silver in a pill, containing 0.01 Gm. (or gr. $^1/_6$) with sugar of milk, glycerin, and water, q. s., giving 2 pills two or three times daily in acute erysipelas, and in cases of gastro-intestinal disease in which it has been customary to give the nitrate of silver. Argyria was not observed.[2]

Dr. Oscar Werler[3] warmly advocates the use of the lactate and citrate of silver, for the power of penetrating the entire organism and effecting a general disinfection of the entire body. In sepsis he obtained good results by inunction and the washing of the wound with citrate-of-silver solution (1 to 4000). The method by inunction with unguentum Credé (made with soluble metallic silver) and local application to the wound of silver-citrate solution, is suited both to chronic sepsis and furunculosis.

Argonin.—An organic combination of silver with casein has been introduced under this name by Drs. Röhmann and Liebrecht. Argonin contains one-fifteenth the amount of silver present in the nitrate. It is soluble in water, non-irritant, not precipitated by salt, and is claimed to be antidotal to the gonococcus. Dr. Johann Jellinek, of Budapest, Hungary, has written on a new preparation of argonin called "Argonin L." He extols this preparation as having the advantage of not decomposing after being kept in solution for several months, and again containing 10 per cent. of silver instead of 4.2 per cent. as in ordinary argonin. The author uses a 1-per-cent. solution in urethritis, both anterior and posterior. (See also **Largin** and **Protargol.**)

ARISTOL.—(See **Thymol Iodidum.**)

ARMORACIA RADIX (B. P.).—**Horse-radish Root.**

Preparation.

Spiritus Armoraciæ Compositus (B. P.).—Compound Spirit of Horse-radish. (Contains also bitter orange-peel and nutmeg.) Dose, 4 to 7.5 c.cm. (or f3i-ij).

Pharmacology and Therapy.—The fresh root of Cochlearia Armoracia collected from cultivated plants.

Horse-radish, in its fresh state, grated to a pulpy mass, to which a little vinegar is added, is a familiar condiment as a dressing for meat at our tables. It is pungent, and excites the flow of secretions of salivary and gastric glands

[1] This is also called "Collargolum," as prepared by von Heyden.
[2] *Klin. Therap. Wochenschrift*, 1898.
[3] *Deutsche medicinische Wochenschrift*, Oct. 6, 1898.

and stimulates the appetite. It contains an active principle analogous to the volatile oil of mustard, and yields about 0.5 per cent. of oil. It also contains a little resin. Externally, horse-radish is rubefacient. Internally, it is a condiment to the stomach and increases the urinary flow. The addition of grated horse-radish to cider makes it actively diuretic, and useful in dropsy. It has been used with success in scurvy. The dried root is not employed in medicine. The compound spirit is a good addition to other diuretics.

ARNICA (U. S. P.).— **Arnica-flowers (Leopard's-bane).**
Dose, in substance, 0.65 to 2 Gm. (or gr. x-xxx).

ARNICÆ RHIZOMA (B. P.).—**Arnica-rhizome.**
Dose, in substance, 0.65 to 2 Gm. (or gr. x-xxx).

Preparations.

Tinctura Arnicæ (U. S. P.).—Tincture of Arnica (20 per cent.). Dose, 0.60 to 2 c.cm. (or *m*x-f3ss).

Tinctura Arnicæ (B. P.).—Tincture of Arnica from the root. (5 per cent).

Pharmacology.—Arnicæ flores, the dried flower-heads of Arnica montana, are official in the U. S. P., but not in the B. P., which recognizes only the rhizome and roots. The plant belongs to the natural order Compositæ, and it is indigenous to northern Europe and Siberia and also the northwestern part of the United States. The flowers are orange-yellow, disk-shaped, with rays, of feebly aromatic odor, and of a bitter, unpleasant taste. **Trimethylamin** has been obtained from the flowers, but the principal constituent to which its local effects are probably due is a **volatile oil**; besides this there is a glucoside, **Arnicin,** and also inulin, tannic acid, resin, and other unimportant elements. According to some writers, arnica also contains two alkaloids, **arnicine** and **cytisine,** the latter of which is apparently identical with the principle of the same name derived from the laburnum.

Physiological Action. — Applied to a delicate skin, arnica frequently produces redness and inflammation resembling erysipelas. A pustular eruption may also be produced by the application of this remedy. It acts as a counter-irritant and revulsive. Internally, in small doses, it has some stimulating influence, raising the blood-pressure and the action of the heart, producing a feeling of warmth over the body and increasing the secretions. It has been shown that small quantities of arnica exert a stimulating influence upon the pneumogastric nerves. Larger doses cause depression, paralysis of the vagi, followed by vomiting and collapse. Death results from the cessation of the heart's action, and in part from the accumulation of carbonic acid in the blood. Atropine is the physiological antidote, with stimulants, artificial respiration, and counter-irritation.

Therapy.—Tincture of arnica is externally used in domestic practice and by some foreign practitioners as a remedy for sprains, contusions, myalgia, or rheumatism and local paralysis, and it is also believed to have some influence over hæmorrhages. It is asserted by some authorities that any power it may have in causing absorption of ecchymosis is really due to the alcohol of the tincture which is commonly used. The author, from clinical experience, believes that arnica has most effective local action upon the tissues, particularly in rheumatism, boils, abscesses, and in all thickened conditions of the integument. The following combinations are especially of value:—

℞ Tinctura arnicæ,
Lin. saponis,
Tinct. opii ..... aa 30| c.cm. or f℥j.
M. Sig.: Apply with friction for boils, abscesses, and thickening of the skin.

℞ Tinctura arnicæ,
Aquæ hamamelidis dest..... aa 90| c.cm. or f℥iij.
M. Sig.: Use on muslin or lint for hæmorrhages. A rheumatic joint may be covered with cloths saturated with the arnica and witch-hazel, the combination often being more effective when applied hot.

Arnica has been used internally in large doses in mania with high arterial excitement, in delirium ebriosum, and in acute rheumatism in sthenic subjects. Small doses of the tincture are useful in fever attended with much depression. This remedy may likewise be beneficially employed in chronic diarrhœa, chronic dysentery, and in various forms of hæmorrhage. It has been thought to be useful in paralysis of the bladder.

ARSENI IODIDUM (U. S. P., B. P.).—**Arsenous Iodide** (AsI_3). (See **Arseni trioxidum** or **Acidum Arsenosum.**)

ASAFŒTIDA (U. S. P., B. P.).—**Asafetida.**
Dose, 0.65 Gm. (or gr. x).

Preparations.

Emulsum Asafœtidæ (U. S. P.).—Emulsion of Asafetida (4 per cent.). Dose, 15 to 30 c.cm. (or f℥ss-j).

Pilulæ Asafœtidæ (U. S. P.).—Pills of Asafetida (each containing 0.20 Gm., or gr. iij, of asafetida). Dose, 1 to 4 pills.

Tinctura Asafœtidæ (U. S. P., B. P.).—Tincture of Asafetida (20 per cent.). Dose, 2 to 4 c.cm. (or f℥ss-j).

Pilulæ Aloes et Asafœtidæ (B. P.).—Pills of Aloes and Asafetida (equal parts of each). Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Spiritus Ammoniæ Fœtidus (B. P.).—Fetid Spirit of Ammonia (contains 7.5 Gm. of asafetida in a menstruum of 10 parts of strong solution of ammonia with 90 parts of alcohol: 90 per cent.). Dose, 1.20 to 2.50 c.cm. (or *m*xx-xl).

Pilula Galbani Composita (B. P.).—Compound Pill of Galbanum (contains 33 per cent. of asafetida). Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Pharmacology.—Asafetida is derived from the rhizome of Ferula fœtida, and probably from other species of Ferula (Umbelliferæ), and is obtained, by incision, from the living root. The source of the asafetida of commerce must still be considered doubtful; it usually is brought to this country from Afghanistan and India. The drug is an oily gum-resin and is a ferulaic ester of asaresinotannol. It occurs as rough, irregular, rather soft masses, of brown color, somewhat garlicky odor, and acrid to the taste. The odor depends upon a **volatile oil,** which appears to be allylpersulphide. The agent also contains **ferulaic acid,** resin, gum, bassorin, with traces of acid calcium malate (Pelletier) and in commerce usually is much adulterated.

Physiological Action.—The effects are moderately stimulating, antispasmodic, and expectorant. Large doses cause vomiting and diarrhœa, especially in persons unaccustomed to its use. In medicinal doses it is carminative, and increases the quantity of the gastric juice. The sexual functions are said to be stimulated, and a general feeling of warmth is diffused through the body. Asafetida increases the action of the heart and arterial

pressure, stimulates the functions of the skin and kidneys, and is a mild cerebral excitant. It is eliminated by the lungs, bowels, skin, and kidneys.

Therapy.—Asafetida is not used locally (although the plaster was formerly official), since, to those unaccustomed to its use, the odor is very offensive. This, however, makes it additionally useful in treating some nervous disorders, such as hysteria. Goodell advised that a teaspoonful of the tincture be mixed with hot water under an hysterical patient's nose, and then given by the stomach, or as an enema. In nervousness of children, the pills are servicable, and in colic, or convulsions, the emulsion or milk of asafetida may be used freely as an injection. The mixture of magnesia and asafetida (not official) is used as a carminative for infants with colic, but the opium in it must not be overlooked. The pil. galbani comp. is used for flatulence and intestinal indigestion, in elderly people. The combination with aloes is theoretically useful in amenorrhœa, but, practically, it is just in these cases that asafetida can only rarely be used, on account of its odor and taste. Italian physicians recommend the systematic administration of asafetida during pregnancy, when there is a history of previous abortions, or when abortion is immediately threatened. It is given in doses gradually ascending from 0.20 to 1 Gm. (or gr. iii-xv) a day, after which the amount is, in the same manner, reduced. Its use is not advocated, however, in cases dependent upon syphilis, tuberculosis, or disease of the uterus and its appendages. The favorable influence of asafetida in these cases has been confirmed by Warman, who found that the drug reduced hæmorrhage, had a tranquillizing effect, and was particularly useful in cases of habitual abortion. Small doses of asafetida are valuable in the later stages of bronchitis, especially that occurring in old people. Its combination of expectorant and carminative virtues likewise renders it of service in emphysema. It may often be advantageously employed in spasmodic asthma, especially used as follows:—

℞ Emuls. asafœtidæ ..... 30| c.cm. or f℥j.
Elix. ammon. valerianatis,
Elix. humuli ..... aa 45| c.cm. or f℥iss.
M. Sig.: A teaspoonful or two in water every hour or two.

As an antispasmodic and expectorant, asafetida has been employed in whooping-cough. It may also be given with advantage in chorea, especially when that affection occurs in weakly girls about the period of puberty and associated with menstrual difficulty. In the flatulence and constipation of hypochondriasis, it is a good remedy, and is especially appropriate on account of its undoubted exhilarant effect upon the brain. The mixture of asafetida injected into the rectum is efficient in promoting the expulsion of flatus, and may be resorted to in the tympanites of typhoid fever. Asafetida can be prescribed internally, thus:—

℞ Tinct. asafœtidæ,
Tinct. cardamom. co. ..... aa 30| c.cm. or f℥j.
Spt. ammon. arom. ..... 4| c.cm. or f℥j.
Aquæ menth. pip. ..... 60| c.cm. or f℥ij.
M. Sig.: One to two teaspoonfuls in water every two or three hours.

ASAPROL.—Calcium beta-naphthol-alpha-monosulphonate ($[C_{10}H_6OHSO_3]_2Ca+3H_2O$) has, for convenience, been termed asaprol. It occurs as a white powder, very soluble in water and alcohol, and is destruc-

tive to many forms of bacteria. It is administered in daily doses of 2 Gm. (or gr. xxx), gradually increasing to 4 Gm. (or ℥j). Asaprol is incompatible with alkaline idodides, sulphates, and with most of the alkaline salts. Quinine and its salts are also incompatible with this compound. Asaprol reduces febrile temperature and augments the secretion of urine. This substance has rendered service in the treatment of influenza, gout, asthma, boils, carbuncles, tonsillitis, etc. Asaprol is of advantage in acute rheumatism, and in chronic forms of the disease it is useful in relieving pain. It is useful, also, in atonic dyspepsia. This remedy has been employed as an antipyretic in typhoid fever and pneumonia and as an analgesic in sciatica, intercostal neuralgia, and tic douloreaux.

ASCLEPIAS.—Pleurisy-root.

Preparation.

Fluidextractum Asclepiadis.—Fluid Extract of Asclepias. Dose, 1 to 4 c.cm. (or *m*xv-f℥j).

Pharmacology.—The root of Asclepias tuberosa (Asclepiadeæ) contains resin and fatty matter. **Asclepiadin** is a mixture of resin and glucoside, precipitated from a strong alcoholic tincture by the addition of cold water, or tannic acid. It has been given in doses of 0.065 to 0.32 Gm. (or gr. i-v).

Physiological Action.—The infusion is used in the southern portion of this country as a diaphoretic and expectorant; in large quantities it is emetic and cathartic. It depresses the heart's action and increases the functional activity of the skin and kidneys.

Therapy.—The recent infusion (31 Gm. to 473 c.cm., or ℥j to Oj; dose, a wineglassful) is used in domestic practice for colds and pulmonary affections of an inflammatory and catarrhal character. In diarrhœa, dysentery, and painful disorders of the stomach or bowels it is often effective, a very good prescription being:—

℞ Fluidext. asclepiadis	60	c.cm. or f℥ij.
Spt. vini gallici	30	c.cm. or f℥j.
Syrup. rubi idæi	90	c.cm. or f℥iij.

M. Sig.: A teaspoonful to a tablespoonful every hour or two, for diarrhœa and dysentery.

As a diaphoretic, it is used in the exanthemata, in order to facilitate the eruption and reduce the fever, and it is said to be advantageous in articular rheumatism, in controlling the inflammation and reducing the heart's action.

A decoction, made from the root-bark of Asclepias syriaca, also possesses diuretic properties, and has been found useful by Dr. G. D. McGauran in the relief of renal dropsy. In œdema of cardiac origin it appears to be of no avail. A tincture of the root of Asclepias verticillata has a popular reputation in the South as an antidote to the bites of venomous serpents and insects, as well as in hydrophobia. Three hundred and sixty c.cm. (or f℥xij) of a hot saturated decoction are said to relieve pain, produce perspiration, and promote sleep.

ASEPTOL. — Sozolic Acid. A syrupy, dark liquid, freely soluble in alcohol, water, and glycerin. It contains orthophenol-sulphonic acid (33 $^{1}/_{3}$

per cent.) diluted with water, and resembles carbolic acid in odor, though fainter. It is less caustic, but is decidedly antiseptic, and is said not to be toxic. When used, it is to be diluted (1 to 20 or more) for surgical practice.

ASPARAGUS.—Asparagus. The root of Asparagus officinalis (Liliaceæ), when fresh, is used in decoction or infusion (31 to 62 Gm. to 473 c.cm., or ʒi-ii to Oj) as a diuretic, laxative, and blood-purifier. The fresh shoots are used as food, and increase the flow of urine, while imparting to it a peculiar, heavy odor; in some cases it has apparently caused congestion of the kidneys, with hæmaturia. **Asparagin,** which is obtained principally from the root, has a sedative action upon the circulation, reducing the force and frequency of the heart's action, and causing frontal headache. The peculiar odor emitted by urine passed after the ingestion of asparagus depends, in all probability, according to Professor Nencki, upon the presence of methyl-mercaptan. This substance is thought to be produced in the albuminous disintegration which accompanies the germination of the plant.

Therapy. — Asparagus was believed by the ancients to have valuable aphrodisiac properties, and was used as an emmenagogue; the writer confirms the observation of Ehrhardt, that a discharge resembling that of gonorrhœa or urethritis may be caused by eating asparagus. Asparagus is usually considered harmful in gonorrhœa. Though it increases or even excites scalding, yet its action appears to be very uncertain. Berkely Hill,[1] in a series of twenty cases, allowed one-half the number to eat asparagus and found that some could partake of it with impunity, while in others it produced increased congestion and flow of discharge.

The ingestion of asparagus, therefore, causes, in some individuals, a disturbance of the functions of the kidney and a notable decrease in the amount of urine excreted. A fluid extract is used in doses of 4 to 15 c.cm. (or ʒi-iv).

It has been claimed that asparagus has special effects upon the uterus as an oxytocic after miscarriage, or in labor. A tincture (1 part of the dried tops to 8 of proof-spirits) is used as a diuretic, in doses of 2 to 4 c.cm. (or fʒss-j) by Dr. Jefferson, of England. Asparagin, in doses of 0.13 to 0.20 Gm. (or gr. ii-iij), may be used as a diuretic in dropsy, and, according to Whitla, appears to act in gout like weak doses of colchicum. It is also of some service in cardiac dropsy, chronic rheumatism, and gout. The combination of asparagin with one of the bromides for the latter affections in this prescription is often of value:—

℞ Asparagin	1	Gm. or gr. xvj.
Sodii bromidi	19 4	Gm. or ʒv.
Syrup. aurantii	120	c.cm. or fʒiv.

M. Sig.: Two teaspoonfuls in water three or four times a day.

ASPIDIUM (U. S. P.).—**Aspidium.**

FILIX MAS (B. P.).—**Male Fern.**

Dose (in powder), 2 to 6 Gm. (or ʒss-iss).

Preparations.

Oleoresina Aspidii (U. S. P.).—Oleoresin of Aspidium. Dose, 2 to 7.5 c.cm. (or fʒss-ij).

[1] "Chronic Urethritis and its Treatment," London, 1890.

Extractum Filicis Liquidum (B. P.).—Liquid Extract of Male Fern. Dose, 3 to 6 c.cm. (or *m*xlv-xc).

Pharmacology.—Aspidium is the dried rhizome of the Dryopteris Filix-mas and of Dryopteris marginalis (Filices) (U. S. P.), and the rhizome of Aspidium Filix-mas (B. P.). The Male Fern, or Dryopteris Filix-mas, is found in almost every portion of the world; the marginalis is indigenous to North America. The rhizome, the portion employed (which deteriorates on being retained for a long time), has a sweetish-bitter, astringent taste, with some slight odor. It contains an active principle, **Filicic acid,** a fixed and volatile oil, filix-tannic, and gallic acids. Its virtues are due to the ethereal extract, or oleoresin. The rhizome of male fern contains intercellular glands, which hold a greenish secretion. When sections of this are preserved in glycerin, crystals are formed, which are soluble in ether. It is to this secretion that the anthelmintic qualities of the drug are due, according to Lauren.[1] The **oleoresin of aspidium** is a dark, thick fluid, of a bitter and nauseous taste. According to Professor Kobert its virtues do not depend entirely upon the filicic acid present, but also upon the **ethereal oil.** From his chemical and physiological investigations E. Poulsson concludes that the crystalline substance heretofore known as filicic acid is really the anhydride of the acid, and he proposes to call it **Filicin.** On standing, filicic anhydride precipitates from preparations of male fern as a granular, white powder without taste or smell, insoluble in water, but soluble in boiling alcohol. If these small crystals are dissolved in alkali and reprecipitated by acid, they become again converted to the active form of filicic acid.

Physiological Action and Toxicology.—Aspidium possesses the power of expelling, and perhaps destroying, tæniæ. Harley believes that it is only able to detach the entozoön from the intestinal wall. It is especially active against the bothriocephalus latus, and the tenia solium.

Large doses of the ethereal extract, or oleoresin, may occasion nausea, vomiting, and choleraic diarrhœa, followed by death from the congestion and inflammation of the gastro-intestinal tract by the irritant action of the drug. In the *Wiener klinische Wochenschrift* is reported the case of a child, 5 $^1/_2$ years old, to whom 7.5 c.cm. (or f3ij) of the oleoresin were given, in three doses, within one hundred minutes. In an hour and a half, part of the tapeworm was expelled, then vomiting occurred, and somnolence, which was followed by twitching, sopor, and trismus of ten minutes' duration, ending in death five hours after the last dose of the extract.

A post-mortem examination of a case of poisoning and death from male fern revealed congestion and ecchymoses of the stomach and blood-clots over its surface. Poisoning from male fern should be treated by the administration of magnesium sulphate and by the hypodermic injection of water of ammonia, from 0.60 to 2 c.cm. (or *m*x-f3ss), properly diluted. When toxic symptoms appear, prompt relief has followed the administration of fresh lemon juice. According to Prevost and Binet, death usually results from paralysis of the heart. Male fern generally reduces the amount of urine secreted.

Therapy.—As a tæniacide, the ethereal extract, or oleoresin, is the most efficient preparation, but being a thick, bitter, naseous substance, it is best given in capsules. It can be given, but not so well, in milk or mucilage. It can be acceptably administered with an equal quantity of aromatic syrup

[1] *Therapeutische Monatsheft,* April, 1899.

of rhubarb. The dose should be preceded and followed by a purgative. Calomel may be given as a preliminary purge. A full dose of castor-oil, two hours after the administration of the remedy, will usually bring away the entire parasite. Trousseau and Pidoux advise the restriction of food to a milk diet for a day or two previous to the institution of the treatment. Whitla has found that male fern is efficient among children, in a reduced dose, when combined with turpentine.

This combination of male fern often acts well:—

℞ Oleoresinæ aspidii	2	c.cm. or f3ss.
Ol. peponis expressi	15	c.cm. or f3ss.
Ol. terebinthinæ	2	c.cm. or *m*xxx.

M. Sig.: Take at a dose after fasting, and follow by a purgative.

Lanara claims good results from the application of male fern in eczema. The formula which he employs is as follows:—

℞ Ext. filicis liquidi (B. P.)	28	c.cm. or 3viiss.
Alcoholis	15	c.cm. or f3ss.
Ext. myrrh., Ext. opii aa	4	Gm. or 3j.

M. Sig.: For external use.

In several cases of cysticercus disease, Dr. R. Feletti has observed improvement to follow the use of ethereal extract of male fern. The result was especially favorable when the lesions were situated in the subcutaneous or muscular tissues.

In Finland, the aspidium spinulosum is used as a tæniacide more frequently than the official drug, as it is a more common variety in this region. It was found to be equally efficient in doses of 1 to 4 Gm. (or gr. xv-lx) of the extract, by Lauren and Schumann.

ASPIDOSPERMA.—Aspidosperma (Quebracho).

Preparation.

Fluidextractum Aspidospermatis.—Fluid Extract of Aspidosperma. Dose, 2 to 4 c.cm. (or f3ss-j).

Pharmacology. — The bark of Aspidosperma Quebracho-blanco (Apocynaceæ) : a large tree of Brazil. It contains six alkaloids, the most important of which is **Aspidospermine.** The others are named Aspidospermatine, Aspidosamine, Quebrachine, Hypoquebrachine, and Quebrachamine. It also contains tannin and two sugars (quebrachit and inosit).

Aspidospermine commercially consists of the mixed alkaloids of the bark. It occurs in the form of colorless crystals, insoluble in water, moderately soluble in alcohol and ether.

Quebracho is also found in Catamarea, of the Argentine Republic, where it has a popular reputation as a febrifuge and antiperiodic. Another species, the red quebracho, contains a large amount of tannin and less of the bitter principles. It is used largely for tanning leather, and is sometimes mixed with white quebracho as an adulteration.

Physiological Action.—Quebracho is bitter and stimulant to the salivary glands, astringent to the intestinal tract. In large doses in animals it produces paralysis of the limbs, of central origin.[1] It also causes salivation, paralysis of respiration, and diminished frequency of the heart's action;

[1] F. Penzoldt, *Berliner klinische Wochenschrift*, No. 19, 1879.

death is caused by paralysis and convulsions due to apnœa. Moderate doses retard breathing, and make inspiration slower and fuller. Aspidospermine increases the respiratory movements in the higher animals by stimulating the respiratory centres. It is said also to cause an excess of oxygen to be taken up by the red blood-cells, and may thus induce apnœa. In man it has no influence upon the temperature or the frequency of the pulse, but is said by Hale to "impart some tonicity to the heart."

Therapy.—The special action upon the motor apparatus of respiration makes quebracho valuable in treating dyspnœa of all kinds, whether bronchial, cardiac, or nervous. In emphysema, with or without asthma, it has been very serviceable in the form of fluid extract, 1.20 to 2.50 c.cm. (or *m*xx-xl), several times a day. Quebracho is also of service in spasmodic croup. Dr. Picot states that it is advantageous to the respiration when taken before hill-climbing. The effect of quebracho in relieving cyanosis is very marked. In the case of a child, suffering with double pneumonia, Dr. Lawrence witnessed decided improvement of the respiration and circulation follow the use of this remedy. This drug very sensibly diminishes the pulse and temperature in acute rheumatism and inflammations of serous membranes. An elixir, a wine (6 per cent.), and a tincture (40 to 50 per cent.) have also been used. The alkaloid, aspidospermine, has been employed as a febrifuge, and, according to Guttmann, its dose as an antiperiodic is 1.20 Gm. (or gr. xviij), the ordinary dose being 0.065 to 0.13 Gm. (or gr. i-ij). It is soluble in oils or 50 parts of pure alcohol. Bardet has given aspidospermine in dyspnœa with good results. In serious cases the drug can be well administered by hypodermic injection. Quebrachine hydrochloride has been given both by the mouth and by hypodermic injection for the relief of dyspnœa, the dose employed being from 0.065 to 0.13 Gm. (or gr. i-ij). Triturates of $^1/_{10}$ and $^1/_{100}$ of aspidospermine (all the alkaloids) are also used. The solid extract is a useful preparation for asthma, given in 0.065 Gm. (or gr. j) doses three times a day. The fluid extract is no longer official.

ASPIRIN, or acetyl-salicylic acid, ($C_6H_4COO\text{-}HCO_2CH_3$), is obtained by heating acetic anhydride with salicylic acid; it occurs in white, crystaline needles, which have a melting-point of 135° C. (275° F.). It is readily soluble in alcohol and ether; not very soluble in cold water; but is soluble in an acid solution like gastric-juice, and gives with ferric chloride, a blue color.

Wohlgemuth[1] reports his results in 10 cases suffering with rheumatoid manifestations; in 2 cases of acute rheumatism in which salicylic acid and antipyrin had been used with negative results, aspirin was given in doses of 3 Gm. (or gr. xlv) daily; the patients improved almost immediately; pain and swelling disappeared within a few days, without any gastric disturbance. The remaining 8 cases were not true joint rheumatism; some had scarlet fever, others diphtheria or angina; these patients were given 1 Gm. (or gr. xv) three times daily for eight days without feeling any ill effects. The action of aspirin on the rheumatic joint is identical with salicylic acid, and is, according to this author, to be preferred to sodium salicylate, chiefly because of its non-irritating character when administered by the mouth; it should be given in powder, and not in a solution. Elberson[2] observed a general erythema produced by five grains of aspirin. It yielded promptly

[1] *Therap. Monat.*, No. 7, 1904.
[2] *Therap. Monat.*, May, 1899.

to salines, and a dusting powder locally. Tinnitus aurium has been noticed after its administration, and it often causes profuse perspiration. Occasionally it depresses the heart. It is recommended as a good antipyretic for la grippe.

ATROPINA (U. S. P., B. P.).—**Atropine** ($C_{17}H_{23}NO_3$).

ATROPINÆ SULPHAS (U. S. P., B. P.).—**Sulphate of Atropine.** (See **Belladonna.**)

AURANTII AMARI CORTEX (U. S. P.). — **Bitter Orange-peel.** The dried rind of the fruit of Citrus Amara, Citrus Bigaradia, and Citrus Vulgaris (Rutaceæ).

AURANTII DULCIS CORTEX (U. S. P.). — **Sweet Orange-peel.** The undried, outer rind of the ripe fruit of Citrus Aurantium (Rutaceæ).

AURANTII CORTEX RECENS (B. P.).—**Fresh Bitter Orange-peel** "The fresh outer part of the pericarp of Citrus Aurantium."

AURANTII CORTEX SICCATUS (B. P.). — **Dried Bitter Orange-peel.** "The dried outer part of the pericarp of Citrus Aurantium."

U. S. P. Preparations.

Oleum Aurantii Corticis.—Oil of Orange-peel.
Fluidextractum Aurantii Amari.—Fluid Extract of Bitter Orange-peel.
Syrupus Aurantii Florum.—Syrup of Orange-flowers.
Syrupus Aurantii.—Syrup of Sweet Orange-peel.
Tinctura Aurantii Dulcis.—Tincture of Sweet Orange-peel (20 per cent.).
Tinctura Aurantii Amari.—Tincture of Bitter Orange-peel (20 per cent.).
Spiritus Aurantii Compositus.—Compound Orange Spirit. Used in making the elixir aromaticum, and also the aromatic fluid extract of rhamnus purshiana.
Elixir Aromaticum.—Aromatic Elixir.
Aqua Aurantii Florum.—Orange-flower Water.
Aqua Aurantii Florum Fortior.—Stronger Orange-flower Water.

The dried peel of bitter orange enters into the U. S. P. compound tinctures of cinchona and gentian. Orange-flower water is used in syrup of calcium lactophosphate.

B. P. Preparations.

Aqua Aurantii Floris.—Orange-flower Water.
Syrupus Aurantii.—Syrup of Orange. Dose, 2 to 4 c.cm. (or f3ss-j).
Syrupus Aurantii Floris.—Syrup of Orange-flower. Dose, 2 to 4 c.cm. (or f3ss-j).
Tinctura Aurantii.—Tincture of Orange. Dose, 2 to 4 c.cm. (or f3ss-j).
Infusum Aurantii.—Infusion of Orange-peel (dried bitter orange-peel, 5 Gm.; boiling distilled water, 100 c.cm.). Dose, 15 to 30 c.cm. (or f℥ss-j).
Infusum Aurantii Compositum.—Compound Infusion of Orange-peel (orange-peel and lemon-peel, with cloves, in boiling distilled water). Dose, 15 to 30 c.cm. (or f℥ss-j).
Vinum Aurantii.—Orange-wine (wine made by the fermentation of a saccharine solution to which fresh bitter orange-peel has been added; 10 to 12 per cent. of alcohol).

The dried bitter orange-peel enters into the B. P. compound spirits of horseradish, and compound tinctures of cinchona and gentian; the tincture of orange into aromatic syrup, and aromatic syrup of cascara.

Pharmacology.—The United States Pharmacopœia preparations are obtained from the bitter, Citrus amara, Bigaradia, or Vulgaris, and from the sweet orange, Citrus aurantium (Aurantiaceæ): the fruit of small trees which grow in warm regions of the Eastern and Western Hemispheres. The British Pharmacopœia preparations are made from the outer part of the pericarp of the Citrus Aurantium.

Therapy.—Orange-juice, with water and sugar, may be used as a drink for fevers and as an antiscorbutic. Care should be taken, after typhoid fever, not to allow children to suck the juice from the orange, as death has been caused by the passage of a seed through an ulcerated patch in the intestine. Death has also been caused by a child's eating the fresh rind, which contains the volatile oil. Erythema, œdema, vesicles, and pustules may be occasioned by paring bitter oranges. The elixir is an agreeable vehicle for other remedies, having the alcoholic strength of a cordial. The other preparations are pleasant flavoring agents.

AURI ET SODII CHLORIDUM (U. S. P.).—**Gold and Sodium Chloride** ($AuCl_3 + NaCl$).

Dose, 0.001 to 0.006 Gm. (or gr. $^1/_{50}$-$^1/_{10}$).

Pharmacology.—A mixture composed of equal parts, by weight, of dry gold chloride and dry sodium chloride, containing not less than 30 per cent. of metallic gold. On account of its position among metals, gold has been credited with having some special medicinal value, although not a normal constituent of the human body. It is practically non-corrosive, and was formerly used to some extent to protect instruments from rusting. In a pure state, gold is too soft for most purposes, although it is the best material for wire and for filling teeth. The only gold preparation official is the gold and sodium chloride. This forms an orange-colored powder, slightly deliquescent in the presence of dampness, freely soluble in water. It is easily decomposed by sunlight and by organic matter, and is best dispensed as a tablet triturate. Lainer has recently prepared a **gold and potassium chloride** by dissolving pure gold in aqua regia by the aid of heat and adding a concentrated solution of potassium chloride. The compound is said to be stable and neither acid nor deliquescent, but no clinical reports of its use have yet been made.

Physiological Action.—The effects of the gold and sodium chloride resemble those of the mercuric chloride. It has very decided bactericidal powers. According to Sternberg, a solution of 1 to 40,000 restrain the growth of anthrax bacillus, and one of 1 to 8000 destroys it. This statement has been questioned by L. Hektoen, who found that 1 to 40,000 delayed the growth, but that 1 to 8000 did not destroy it. A strength of 1 to 1000 destroys the bacillus of diphtheria and 1 to 500 the bacillus of typhoid fever. Gibbes and Shurley demonstrated its bactericidal power against bacillus tuberculosis by physiological experiments upon animals.[1] In concentrated solution it has an escharotic action upon the skin. Internally, in very small doses, it acts upon the glandular structures of the stomach and liver,—stimulating nutrition and assimilation; but, in larger doses, it produces violent gastro-enteritis, without ulceration or salivation. These symptoms have been produced in an adult by 0.065 Gm. (or gr. j), and this same dose has

[1] *Therapeutic Gazette*, April 15, 1891.

produced death in a dog in four minutes, as reported by Daniel R. Brower.[1] In anæmia it increases the percentage of hæmoglobin and the number of red blood corpuscles, but large doses reduce the oxidizing power of the red blood-cells. Large doses excite salivation, but do not affect the teeth, cheeks, or gums. This salt exercises a constipating effect upon the bowels. Upon the brain and spinal cord its effects are those of a tonic. In some instances it produces decided mental exhilaration. When its use has been too long continued it gives rise to what has been termed "auric fever," a condition characterized by profuse sweats and an increase of saliva and urine. The remedy acts upon the kidneys, increasing the urinary flow, and the secretion, after large doses, is colored yellow. Renal hyperæmia with albuminuria is caused by toxic doses. It is claimed that gold has aphrodisiac powers, causing painful erections in men and increasing the menstrual flow in women. Gold is removed from the body chiefly by the kidneys, but to some extent also by the liver and bowels. For the gastro-enteritis, vomiting, etc., similar to corrosive chloride of mercury, caused by large doses, the antidote is albumin and demulcents.

Therapy.—From the physiological action upon the glandular system of the stomach and liver, and the resulting improvement in the powers of assimilation, gold may be especially valuable in atonic dyspepsia, enabling the patient to digest more food. It is of decided service in nervous dyspepsia. Also, in gastric catarrh, chronic inadequacy of the hepatic functions (torpid liver), and early stage of cirrhosis, the gold and sodium chloride is a useful remedy. Administered in this prescription, it often is most effective in gastric catarrh and torpid liver:—

℞ Auri et sodii chloridi	.03	Gm. or gr. ss.
Ext. nucis vomicæ	.20	Gm. or gr. iij.
Ext. taraxaci	4	Gm. or ʒj.

M. et ft. pil. no. xxx.
Sig.: Two pills three times a day.

In cirrhosis of the kidney, and albuminuria due to interstitial nephritis, according to Millard, it has a special place. Culbertson reports relief of a case of albuminuric retinitis from gold and sodium chloride. This salt is beneficial in arteriosclerosis and the vertigo of the aged dependent upon atheromatous vessels, and also in vertigo due to indigestion. It is useful in hysteria and functional impotence. In spasmodic affections (whooping-cough, laryngismus stridulus) it has some advocates. Where amenorrhœa or dysmenorrhœa is due to deficient innervation, and not to local lesion or obstruction, this remedy has given good results, and also in habitual abortion. Uncomplicated chronic ovaritis is benefited by the administration of gold. The double salt is also said to afford relief from ovarian neuralgia. Following out the physiological action, we find that, in spinal sclerosis, premature senility, in depression and hypochondria, it has a high degree of efficiency. This remedy has also been given with advantage in neurasthenia, progressive general paralysis, utero-ovarian congestion, menorrhagia, subacute metritis, nymphomania, and spermatorrhœa. Dr. John Strahan, of Belfast, suggests that it may be useful in insomnia dependent upon cerebral anæmia. In the treatment of impotence, Professor Glenn, of the University of Tennessee, has found the following combination of service:—

[1] *Journal American Medical Association*, Oct. 1, 1899, p. 754.

℞ Auri et sodii chloridi ..... | 20 Gm. or gr. iij.
Strychnin. sulphat. ..... | 065 Gm. or gr. j.
Zinci phosphidi ..... | 20 Gm. or gr. iij.
Ext. damianæ ..... 4 | Gm. or ʒj.
M. et ft. in capsulas no. xxx.
Sig.: One capsule thrice daily.

Gold and sodium chloride is, in some cases, an efficient substitute for mercuric chloride in the treatment of syphilis, and it has been given in this combination, where there was an undue susceptibility to mercury, with decided benefit:—

℞ Auri et sodii chloridi..... | 065 Gm. or gr. j.
Ext. sanguinariæ ..... | 13 Gm. or gr. ij.
Ext. calumbæ ..... 2 | Gm. or gr. xxx.
M. et ft. pil. no. xxx.
Sig.: One pill three times a day.

Gold also proves of avail in the late manifestations of syphilis, and is sometimes effectual, after failure of the mixed treatment by means of mercury and iodine, or when these remedies cannot be borne on account of idiosyncrasy or debility. It has been of service in ulcerations of the throat, laryngitis, ozæna, diseases of the bones, and syphilitic cachexia. Dr. J. A. Robinson reports two cases of diabetes mellitus in which gold and sodium chloride caused a steady decrease and final disappearance of glycosuria. In hypochondria and melancholia the double salt is highly recommended. In one case of pyelitis, Dr. G. Frank Lydston, of Chicago, found the hypodermic injection of gold and sodium chloride to produce decided improvement. Gold chloride is useful in the treatment of chronic tobacco poisoning and morphine addiction.

From the results of fifty-two experiments made upon various species of warm-blooded animals, Calmette concludes that the subcutaneous injection of gold is antidotal to the poison of the cobra di capello. He believes that the venom may be neutralized, even after it has been absorbed, and that the treatment may be successfully applied to human beings. His method is to cast an elastic ligature around the limb, to inject 7.50 to 9.25 c.cm. (or f3ii-iiss) of a 1-per-cent. solution of gold chloride into the wound and beneath the surrounding skin, not more than 1 c.cm. (or *m*xv) being deposited at any one spot. Injections are also made at the level of the ligature as well as between it and the heart. The solution may be thrown either into the connective or muscular tissue. As soon as the injections have been made, the ligature may be removed. The method merits trial in the case of bites from other venomous serpents, since, as Weir Mitchell has shown, the poisons are substantially of the same chemical composition.

In appropriate cases this salt may be given under the skin. Thus Gibbes and Shurley[1] have reported successful results in twenty-seven cases of pulmonary tuberculosis, by gold and sodium chloride given hypodermically, in doses of 0.003 to 0.01 Gm. (or gr. $^1/_{20}$-$^1/_6$), during three to eight months. Pepper also reported a case of phthisis apparently cured by this drug.[2]

Dr. Joseph Drzewiecki reports the cure of a case of lupus by the internal

[1] *Loc. cit.*
[2] *University Medical Magazine*, Dec., 1895.

administration of the same salt in the dose of 0.0003 Gm. (or gr. $^{1}/_{150}$) three times a day.

AVENA.—Oat, the fruit of Avena sativa (Gramineæ), is used as a food in the form of meal, of which cakes, gruel, or porridge is made. It is a highly-nutritious food, containing oil, nitrogenized principles, carbohydrates, phosphates, etc.; but on account of its concentrated form and the presence of irritating fragments of the outer coat, containing silica, oatmeal is likely to cause indigestion, and in young children diarrhœa. The habit of eating porridge with milk and large quantities of sugar is apt to cause sour stomach and pyrosis, which may be avoided by using butter or cream and salt instead of the milk and sugar. Skin eruptions have been attributed to the use of oatmeal, particularly eczema, in infants, which are cured by a change of diet. An alcoholic tincture of oats has been supposed to have a sedative action upon the cerebral centres and to remove the craving for drink. For the latter, it would be more rational to recommend an infusion than a tincture.

AZEDARACH.—Azedarach (Pride of China). The dried root-bark of Melia azedarach (Meliaceæ) is used in our Southern States in the form of a decoction (124 Gm. to 946 c.cm., or ℥iv-Oij, boiled down to 473 c.cm., or Oj), as a vermifuge, in cases of round worm 15 c.cm. (or f℥ss) being given to a child every two or three hours until the bowels are freely moved. Large doses may cause vertigo, dilated pupils, and stupor. A fluid extract has been also used (dose, 4 c.cm., or f3j), but the fresh decoction is the best preparation.

BALSAMUM CANADENSE.—Canada Turpentine. (See **Terebinthina Canadensis.**)

BALSAMUM PERUVIANUM (U. S. P., B. P.).—**Balsam of Peru.**

Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Pharmacology.—A balsam obtained from Toluifera Pereiræ (Leguminosæ) U. S. P.; Myroxylon Pereiræ (B. P.) : a tree of Central America. It is a brown, heavy liquid, of fragrant odor and a warm, rather acid taste, containing resin, volatile oil, and both benzoic and cinnamic acids. It is inflammable, burning with a white smoke and fragrant odor. It is entirely soluble in 5 parts of alcohol, and should not diminish in volume when agitated with an equal bulk of benzin or water. The National Dispensatory states that the balsam contains 60 to 64 per cent. of benzyl benzoate (C_7H_5 $C_7H_7O_2$), a colorless oil, vanillin, cinnamic acid, benzyl cinnamati, and 30 to 38 per cent. of resin, composed of benzoic and cinnamic esters of peruresino-tannol.

Physiological Action and Therapy.—Peruvian balsam is carminative, stimulant, and expectorant. It has been extolled in Europe by Landerer and Schnitzler in phthisis pulmonalis and chronic bronchial catarrh, given in capsules or emulsion, and also used in an inhaler. Professor Landerer has convinced himself that the virtue of balsam of Peru in tuberculosis depends upon the presence of **cinnamic acid,** which he has of late employed in place of the balsam. The cinnamic acid of which he makes use, however, is obtained from storax. It is colorless, crystalline, feebly soluble in cold water, freely soluble in hot water, alcohol, and warm oil. A 5-per-cent. emulsion of the acid is prepared with almond-oil, yelk of egg, and normal salt solu-

tion. Before use, the emulsion must be rendered alkaline by a few drops of a 25-per-cent. solution of liquor potassæ. The emulsion is preferably thrown into a vein. The method is not applicable to the later stages of pulmonary tuberculosis. From 0.12 to 0.37 c.cm. (or *m*ii-vj) of the emulsion are injected twice a week. In lupus, Landerer employs an alcoholic solution of 1 part of cinnamic acid, 1 part of cocaine hydrochlorate, and 20 parts of alcohol, 0.06 to 0.12 c.cm. (or *m*i-ij) being injected into the nodules till 0.60 c.cm. (or *m*x) have been used at one *séance*. At the end of a week the procedure is repeated. As it is a deodorant and antiseptic, it is useful as a local application to open wounds and compound fractures, and also in the treatment of ozæna and old ulcers. In uterine affections we may use:—

℞ Iodoformi ..... 15 | 5 Gm. or 3iv.
Balsami Peruviani ..... 7 | 5 c.cm. or f5ij.
Adipis lanæ hydrosi ..... 62 | Gm. or 3ij.
M. Sig.: For local application on absorbent cotton or carded wool.

In infantile eczema we may prescribe:—

℞ Acidi borici ..... 2 | Gm. or 3ss.
Balsami Peruviani ..... | 60 c.cm. or *m*x.
Adipis lanæ hydrosi ..... 31 | Gm. or 3j.
Ol. amygdalæ expressi ..... q. s. ft. ungt.
M. Sig.: Apply frequently upon soft linen.

Balsam of Peru, pure or in an ointment, is an efficient application in pruritus of the vulva and senile paræsthesia. It is likewise efficacious in scabies. Leucoplakia, or local epithelial thickening of the mucous membrane, is removed by applications of Peruvian balsam; in leprosy it may be thoroughly rubbed into the affected areas. It is also a good local application for diphtheria. The internal use of Peruvian balsam has been recommended by Trousseau and Pidoux in chronic intestinal catarrh and typhoid fever. Nuggia has found it serviceable in the gastro-intestinal disorders of childhood. The external application of balsam of Peru has, in some instances, been followed by an erythematous, urticarial, or eczematous eruption. Dr. Lohaus has reported a case of fatal gastritis in a six-day-old babe caused by balsam of Peru which had been applied to the mother's nipples on account of fissures.

BALSAMUM TOLUTANUM (U. S. P., B. P.).—**Balsam of Tolu.**
Dose, 0.32 to 1 Gm. (or gr. v-xv).

Preparations.

Tinctura Tolutana (U. S. P., B. P.).—Tincture of Tolu (20 per cent.). Dose, 2 to 4 c.cm. (or f3ss-j).

Syrupus Tolutanus (U. S. P., B. P.).—Syrup of Tolu. Dose, 7.5 c.cm. (or f3ij) or more. B. P., 2 to 4 c.cm. (or f3ss-j).

Tinctura Benzoini Composita (U. S. P., B. P.).—The compound tincture of benzoin contains Tolu. Dose, 1.30 to 4 c.cm. (or *m*xx-f3j).

Pharmacology and Therapy.—A balsam obtained from Toluifera Balsamum (Leguminosæ; U. S. P.); Myroxylon Toluifera (B. P.): a tree of New Granada. It is a resinous exudation, which yields 7 per cent. of an acid, aromatic, oily liquid, chiefly benzyl benzoate, with a little benzyl cinnamate Also 0.5 to 1 per cent. of a volatile oil, chiefly **Tolene**, and 75 to 80 per cent. of resin. It has an agreeable odor and taste.

Balsam of Tolu is, when fresh, a thick, viscid fluid, but is, in time, converted into a hard, translucent solid. It is slightly antiseptic and expectorant; the syrup is a favorite basis for cough-mixtures, chiefly on account of its pleasant taste. The balsam itself may be administered in emulsion with egg or mucilage. It should not be used during acute attacks of inflammation. The syrup covers the taste of chloral or croton-chloral (Brunton).

BAPTISIA. — Wild Indigo. The root of Baptisia tinctoria (Leguminosæ), indigenous to North America. **Baptisin,** an impure resin, is considered to have cholagogic properties (dose, 0.065 to 0.32 Gm., or gr. i-v), and has been found of service in amenorrhœa. The decoction or fluid extract may be used as a cathartic in large doses, or tonic astringent in small. In typhoid fever and bowel disorders, small doses of a tincture have been used, but not according to the best practice. The decoction may be employed as a douche in nasal catarrh, chronic ulcers, leucorrhœa, etc., or as a mouth-wash in stomatitis.

BARII CHLORIDUM.—Barium Chloride. Barium, in its action upon the blood-vessels, resembles both ergot and digitalis. It causes the cardiac contractions to become more slow and forcible. Tonic spasm of involuntary muscular fibre is produced, peripheral blood-vessels are constricted, and blood-pressure rises. Peristalsis is likewise excited. Overdoses give rise to salivation, thirst, vomiting, purging, embarrassed breathing, slow pulse, dilated pupils, and paralysis of the extremities. In experiments upon animals Pilliet and Malbec found that barium chloride, injected subcutaneously in toxic doses, caused diarrhœa, albuminuria and hæmoglobinuria, and convulsions, followed by rigidity. After death lesions were found in most of the organs. The glomeruli of the kidneys were particularly affected, and hæmorrhages into the straight tubes were also observed. According to M. Bardet, barium chloride occasions coagulation of the blood, and death results mechanically from embolism. Death has occurred in consequence of 0.17 Gm. (or gr. iiss), the quantity not having been taken in one dose, but in daily portions of 0.015 Gm. (or gr. $^1/_4$). The symptoms of intoxication manifested themselves at the end of a week. Barium chloride is a white, crystalline substance, of a bitter and disagreeable taste, readily soluble in water. This salt is scarcely soluble in absolute alcohol, but dissolves in rectified spirit. The sulphates are incompatible with the salts of barium. In cases of poisoning, the sodium, or magnesium, sulphate, with white of egg, may be used as antidotes. Usual dose is 0.006 to 0.03 Gm. (or gr. $^1/_{10}$-$^1/_2$) in solution.

Therapy.—Barium chloride may be used as a cardiac tonic in valvular insufficiency with irregularity of the heart. Mr. A. C. Crawford of the U. S. Bureau of Plant Industry, has recently investigated the plants which produce so-called "loco-poisoning" of cattle and finds them rich in inorganic salts, and all contain barium. He also found that by feeding small doses of barium to animals, he could produce the symptoms of "loco." This illustrates the cumulative effect of barium poisoning on animals. A few cases of chronic poisoning in man have been reported, producing serious or fatal results.

From an administration of this salt to seventy-six children, Lelli concludes that it is efficacious in the gastritis which accompanies the torpid form of scrofula, but that it is injurious in the florid form. In the begin-

ning, the remedy irritates the mucous membrane of the bowel and renders the process more acute, but the membrane is finally favorably modified. Barium has been recommended likewise in chlorosis and in cachectic conditions. In amenorrhœa it has been given with advantage. It has yielded good results in varicose veins and aneurism. It affords relief to the vascular phenomena of exophthalmic goitre.

An ointment of barium chloride ($^1/_2$ to 1 per cent.) has been used for reducing enlarged glands.

BARII DIOXIDUM (Not Official).—**Barium Dioxide** (BaO_3).

Preparations.

Aqua Hydrogenii Dioxidi (U. S. P.).—Solution of Hydrogen Dioxide, or Peroxide of Hydrogen. Three per cent. by weight of pure H_2O_2, equivalent to ten volumes of available oxygen.

Liquor Hydrogenii Peroxidi (B. P.).—Solution of Hydrogen Peroxide. Dose, 2 to 7.5 c.cm. (or f3ss-ij).

The dioxide, or peroxide, of barium should be anhydrous and kept in well-closed vessels. It is used in the manufacture of the solution of bleaching liquid, or dioxide of hydrogen, now entering largely into use for medical and surgical purposes.

Pharmacology.—The commercial dioxide of hydrogen is a colorless solution of this agent in water. It is, when undiluted, a syrupy fluid, destitute of odor, of a harsh, slightly-acrid taste, has a specific gravity of 1.45, and is of very unstable composition. Its formula is H_2O_2, and it decomposes into water and nascent oxygen, yielding 475 times its own volume of oxygen and leaving behind 1 volume of water. The freshly prepared official solution contains about 3 per cent., by weight, of the pure dioxide. This dilution is a clear fluid, having but little odor or taste, and is of a slightly-acid reaction, corresponding to about 10 volumes of available oxygen. Another strength employed by surgeons is called the 15-volume solution, because each portion of the solution yields 15 volumes of the oxygen. It is an active oxidizing and antiseptic agent. As it gradually decomposes it must be kept in a cool place and in loosely-stoppered bottles in order to prevent explosion.

Physiological Action and Therapy.—The solution of hydrogen dioxide destroys pus and the micro-organisms, which excite suppuration, and coagulates the albuminoid components of the inflammatory products. It has also the property of checking fermentation. It is destructive to the pathogenetic micro-organisms and is an excellent agent for purifying drinking-water. Dr. Jakovleff has ascertained by experiment that the solution of hydrogen dioxide increases the general acidity of the gastric juice and the proportion of free hydrochloric acid, but diminishes the amount of lactic acid. It produces a marked increase of the digestive power of the gastric juice. When pure and of official strength, it is free from irritating qualities, and can be poured over wounds, injected into sinuses, or into the ear, or used as a spray in ulcerations of the pharynx and of the larynx. It produces a frothing up when it encounters pus, owing to the liberation of oxygen, and the cessation of this commotion indicates the removal of all the pus. The surface of the wound or ulcer becomes blanched, but is not injured by the application. As a rule, the fluid exerts an analgesic effect upon the surface with which it is brought into contact. Tubercular and mammary abscesses especially are

well treated in this way. Boils, carbuncles, felons, and ulcers are improved and their pain assuaged by the use of this remedy. Unhealthy or poisoned wounds and phlegmonous erysipelas receive decided benefit from the use of hydrogen dioxide. This solution is a beneficial application in cases of senile gangrene, phagedena, and syphilitic ulceration. It is peculiarly adapted for injection into cavities, fistulas, and sinuses communicating with bones or joints. This fluid, moreover, possesses the valuable property of disintegrating carious or necrosed bone, and is, therefore, of service in hip-joint disease. Granular pharyngitis and stomatitis are benefited by the same application. It has been utilized with advantage for the purpose of disinfecting cavities in carious teeth, in the treatment of abscesses of the alveoli or antrum, and for bleaching discolored teeth.

For the last-named purpose it is made into a paste with chalk or cuttlebone. It enables the dentist to blanch and fill at the same sitting a sensitive pulp or cavity. Dr. H. F. Brownlee, of Danville, Conn., made use of hydrogen dioxide with marked advantage in a case of empyema which was characterized by the excessive amount of pus evacuated from the pleural sac.

For comedones, Unna advises the use of a preparation containing from 20 to 40 parts of hydrogen dioxide, 10 parts of lanolin, and 20 parts of vaselin. The application of the liquid is also of avail in acne. Hydrogen dioxide, on account of its bleaching properties, may be used to decolorize the dark lanugo hairs which not infrequently disfigure the faces of women. M. Gallois prefers hydrogen dioxide to tincture of iodine, as a parasiticide application in pityriasis versicolor. It is also effective in trichorrhexis barbæ.

Dr. Golovin commends the action of hydrogen dioxide in various diseases of the conjunctiva and cornea. In ulcers of the cornea suppuration is diminished and healing promoted. Infiltrations undergo absorption. The remedy is of value in hypopyon, and may render operative interference unnecessary. Hydrogen dioxide is likewise beneficial in phlyctenular conjunctivitis and acute gonorrhœal ophthalmia. It has been used with good results in dacryocystitis. It is serviceable in suppurative diseases of the ear. Hydrogen dioxide has given very favorable results in the treatment of mastoid disease, being doubly beneficial by virtue of its action, both upon the pus and the bone. Care should always be taken to provide a free outlet for the frothy discharge caused by the peroxide, or pain will be increased and pus may be driven deeper into the attic and cells, and extend the infection.

In ulcerative tonsillitis, fetid breath, and in some bronchial affections, a spray of dilute hydrogen dioxide is productive of benefit. A spray of this agent is likewise of utility in chronic nasal catarrh, ozæna, and scarlatinal angina. It should be made alkaline before using. Hydrogen dioxide is a useful application in mercurial and other forms of stomatitis, and is also used as a disinfectant of the mouth during febrile and wasting diseases.

In diphtheria and croup its value has been established: a 2-volume solution is specially recommended in young children as a local application, and particularly after separation of the membranes in order to remove the odor and disinfect the surface.[1] It is stated by Dr. A. Jacobi, of New York, that in certain instances even a weak solution proves irritant to the throat, abrades the mucous membrane, and that it, consequently, sometimes proves

[1] Dr. E. R. Squibb, "On the Medical Uses of Hydrogen Peroxide," *Gaillard's Medical Journal*, March, 1889.

detrimental in diphtheria and must be abandoned in such cases. In gynæcological practice this remedy has effected improvement in vaginitis and endometritis, and in chronic cystitis. It may be beneficially employed, likewise, in septic conditions resulting from abrasions or wounds of the female genital tract. It has been used with success in the treatment of gonorrhœa, of both sexes. It is thought to be especially valuable in the chronic form of the disease. Dr. Willard Parker Worster, of New York, has obtained good results from the treatment of chancres by hydrogen dioxide. The ulcer was sprayed every day and in the interval kept covered with iodol.

In surgery of the nose, hydrogen dioxide is used as a styptic. It is also of advantage in the treatment of passive hæmorrhages. It may be employed in the form of a spray for the relief of pulmonary hæmorrhage, or injected in cases of hæmaturia and hæmorrhages of the lower bowel. Spraying the post-nasal passages with a 1- or 2-per-cent. solution, combined with an alkali, will generally check epistaxis, even of severe type.[1] In carcinoma of the rectum or uterus it relieves pain and cleanses the diseased surfaces. The use of a spray of a 10-volume solution is recommended as a disinfectant of the sick-room in case of eruptive fevers and other infectious diseases.

It has been administered, well diluted, in gastric affections, and has been found useful in flatulent dyspepsia, heartburn, catarrh of the stomach and bowels, etc. It would probably be of service in the treatment of gastric ulcer. It has even ameliorated the symptoms of cancer of the stomach. Hydrogen dioxide, combined with tannin and injected into the intestine, is beneficial in chronic dysentery. Irrigation of the bowel by means of liquid soap, potash, and glycerin, combined with the internal administration of hydrogen dioxide, was found by Dr. Elmer Lee to yield favorable results in Asiatic cholera. In cholera nostras, typhoid and yellow fevers, the use of this agent either by irrigation or by the mouth promises to be of superior efficacy.

Sir Benjamin Ward Richardson, of London, has employed this agent for more than thirty years, beginning at a time when it was regarded as a chemical curiosity. He has reported a case of epilepsy of long standing cured by the use of 7.5 c.cm. (or f℥ij) of a 10-volume solution twice daily in water. He advises a systematic trial of this remedy in epilepsy, especially in the Jacksonian variety. From a number of formulæ which have been published by Dr. Richardson the following have been selected:—

℞ Acid. tannic.	65	Gm. or gr. x.
Glycerin.	30	c.cm. or f℥j.
Sp. vini rectificat.	15	c.cm. or f℥ss.
Aq. destillat.	120	c.cm. or f℥iv.
Aq. hydrog. diox. (10 vol.)	q. s. ad 240	c.cm. or f℥viij.

M. Sig.: An antiseptic and astringent gargle.

℞ Aq. hydrog. diox. (10 vol.)	15	c.cm. or f℥iv.
Acid. tannic. pur.	32	Gm. or gr. v.
Aq. rosæ	q. s. ad 240	c.cm. or f℥viij.

M. Sig.: A useful collyrium.

℞ Aq. hydrog. diox. (10 vol.)	75	c.cm. or f℥iiss.
Acid. sulphuric. dil.	2	c.cm. or f℥ss.
Glycerin.	15	c.cm. or f℥ss.
Aq. destillat.	q. s. ad 180	c.cm. or f℥vj.

M. Sig.: Dose: two tablespoonfuls, well diluted. An excellent mixture in the colliquative sweating of phthisis.

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[1] *New York Medical Journal*, Nov. 26, 1892.

℞ Aq. hydrog. diox.	75	c.cm. or f℥iiss.
Liq. morphin. hydrochlor.	4	c.cm. or f3j.
Syr. tolutan	22	c.cm. or f3vj.
Aq. destill.	q. s. ad 180	c.cm. or f℥vj.

M. Sig.: Dose: one ounce, diluted with iced water. Recommended in asthenic bronchitis and phthisis with severe cough and sleeplessness.

℞ Aq. hydrog. diox.	75	c.cm. or f℥iiss.
Syr. codein.	7.5	c.cm. or f3ij.
Sp. vini rectificat., Glycerin.	aa 22	c.cm. or f3vj.
Aq. destillat.	q. s. ad 180	c.cm. or f℥vj.

M. Sig.: Dose: one ounce in iced water. A palliative of decided value in diabetes, giving much better results than codeine alone.

℞ Aq. hydrog. diox.	75	c.cm. or f℥iiss.
Acid. phosphor. dil.	4	c.cm. or f3j.
Syr. ferri superphos.	22	c.cm. or f3vj.
Glycerin.	30	c.cm. or f℥j.
Aq. destill.	q. s. ad 180	c.cm. or f℥vj.

M. Sig.: Dose: one ounce in iced water. Recommended in asthenic cases. Used with advantage in the early stages of phthisis.

Pyrozone.—This name has been given to different standard solutions of hydrogen dioxide in water and ether. Medicinal pyrozone contains 3 per cent. of hydrogen dioxide in water. It is used internally and externally as an antiseptic remedy. Antiseptic pyrozone is a 5-per-cent. solution in ether, and is recommended as an application to ulcers, rhinitis, and diphtheria. In this strength pyrozone is used by dentists during operations, having been found of decided assistance in arresting bleeding and keeping the parts perfectly dry. Caustic pyrozone, a 25-per-cent. solution in ether, is an efficacious remedy in common and syphilitic ulcers, sinuses, etc. In dentistry it has been employed for the purpose of bleaching the teeth, in the treatment of dental abscesses, and in pyorrhœa alveolaris (Riggs's disease).

BELLADONNÆ FOLIA (U. S. P., B. P.).—**Belladonna-leaves.**

BELLADONNÆ RADIX (U. S. P., B. P.).—**Belladonna-root.**

Dose of powdered leaves or root, 0.006 to 0.13 Gm. (or gr. $^1/_{10}$-ij).

U. S. P. Preparations.

LEAVES.

Extractum Belladonnæ Foliorum.—Extract of Belladonna-leaves. Dose, 0.0015 to 0.065 Gm. (or gr. $^1/_{40}$-j).

Tinctura Belladonnæ Foliorum.—Tincture of Belladonna-leaves (10 per cent.). Dose, 0.30 to 1.20 c.cm. (or *m*v-xx).

Unguentum Belladonnæ.—Ointment of Belladonna (contains, of the alcoholic extract, 10 per cent.).

Emplastrum Belladonnæ.—Belladonna Plaster.

Pilulæ Laxative Compositæ (U. S. P.).—Compound Laxative Pills (aloin, 1.3 Gm.; strychnine, 0.05 Gm.; extract belladonna-leaves, 0.8 Gm.; and ipecac, 0.40 Gm.: with licorice in powder, to make 100 pills. Each pill contains about 0.0005 Gm. [or gr. $^1/_{120}$] of strychnine, and 0.008 Gm. [or gr. $^1/_8$] of belladonna-extract). Dose, 1 or 2 pills.

Pilulæ Podophylli, Belladonnæ, et Capsici (U. S. P.).—(Each pill contains resin of podophyllin, 0.015 Gm. [or gr. $^1/_4$]; extract of belladonna, 0.0075 Gm. [or gr. $^1/_8$]; capsicum, 0.03 Gm. [or gr. $^1/_2$]; with acacia and sugar of milk.) Dose, 1 to 3 pills.

ROOT.

Fluidextractum Belladonnæ Radicis.—Fluid Extract of Belladonna-root. Dose, 0.006 to 0.12 c.cm. (or $m^1/_{10}$-ij).

Linimentum Belladonnæ.—Belladonna Liniment (contains, of fluid extract, 95; camphor, 5 parts).

B. P. Preparations.

LEAVES.

Extractum Belladonnæ Viride.—Green Extract of Belladonna (from fresh leaves and young branches). Dose, 0.015 to 0.065 Gm. (or gr. $^1/_4$-j).

Succus Belladonnæ.—Juice of Belladonna. Dose, 0.30 to 1 c.cm. (or *m*v-xv).

ROOT.

Extractum Belladonnæ Alcoholicum.—Alcoholic Extract of Belladonna (containing 1 per cent. of alkaloids of belladonna-root). Dose, 0.015 to 0.065 Gm. (or gr. $^1/_4$-j).

Extractum Belladonnæ Liquidum.—Liquid Extract of Belladonna (contains $^3/_4$ of 1 per cent. alkaloids). Dose, 0.03 to 0.06 c.cm. (or *m*ss-j).

Tinctura Belladonnæ.—Tincture of Belladonna. Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Linimentum Belladonnæ.—Liniment of Belladonna (contains liquid extract of belladonna, 25 c.cm.; camphor, 2.5 Gm.; distilled water, 5 c.cm.; alcohol, 90 per cent., q. s. ad 50 c.cm.).

Unguentum Belladonnæ.—Belladonna Ointment (100 parts contain 0.6 part of the alkaloids of belladonna-root).

Emplastrum Belladonnæ.—Liquid Extract and Resin Plaster (contains $^1/_2$ per cent. of the alkaloids of belladonna-root).

Suppositoria Belladonnæ.—Belladonna Suppositories (each contains 0.001 Gm., or gr. $^1/_{60}$, of the alkaloids of belladonna-root).

Active Principles and Preparations.

Atropina (U. S. P., B. P.).—Atropine ($C_{17}H_{23}NO_3$). Dose, 0.0003 to 0.001 Gm. (or gr. $^1/_{200}$-$^1/_{60}$).

Atropinæ Sulphas (U. S. P., B. P.).—Atropine Sulphate. Dose, the same as atropine.

Oleatum Atropinæ (U. S. P.).—Oleate of Atropine (contains 2 per cent. of atropine).

Unguentum Atropinæ (B. P.).—Atropine Ointment (2 per cent.).

Liquor Atropinæ Sulphatis (B. P.).—Solution of Atropine Sulphate (1 per cent.). Dose, 0.03 to 0.06 c.cm. (or *m*ss-j).

Lamellæ Atropinæ (B. P.).—Discs of Atropine (each 0.013 mgr., or gr. $^1/_{5000}$, of atropine sulphate).

Pharmacology.—The dried leaves and the root of Atropa Belladonna (Solanaceæ), or deadly nightshade, are each official. The dried leaves must yield, when assayed by the United States Pharmacopœia process, not less than 0.35 per cent. of its alkaloids. The root is required to yield not less than 0.5 per cent. of its alkaloids. It is a native of Europe, and is cultivated here. All parts of the plant are active. The erect, purplish, branching stems stand about three feet high, and the leaves with short stalks are in pairs of unequal size, oval, entire. The large, cultivated leaves are said to have less of the active principle than the smaller leaves gathered while the plant is in flower. The roots are taken from plants at least three years old; those which are tough and woody, breaking with a splintering fracture, should be rejected. Belladonna contains **atropine** and **hyoscyamine**, or belladonnine. The United States Pharmacopœia defines atropine as "an alkaloid derived from Atropa Belladonna and other plants of the same family. As it occurs in commerce, it is usually accompanied by a small portion of hyoscyamine, from which it cannot be readily separated." The sulphate of atropine is a more permanent salt, neutral to litmus-paper, read-

ily soluble in water, and is generally preferred for medical purposes to the alkaloid. Atropine chemically is tropyltropeïne (formula $C_{17}H_{23}NO_3$), and has been synthetically made by heating together tropine and tropic acid. By substituting different acids, Ladenberg obtained salicyl-tropeïne, benzoyl-tropeïne, cynnamyl-tropeïne, etc. Atropine and hyoscyamine are isomeric, but the former is the more stable form.

Physiological Action. — Locally, belladonna affects the end-organs of the sensory nerves, and reduces painful sensibility, contracts the vessels, and checks the action of the sweat- and mammary glands. It is readily absorbed through the unbroken skin, and symptoms of poisoning have appeared after its topical application. When applied to the eyes, belladonna (or its alkaloids) widely dilates the pupil and relaxes the ciliary muscle, so as to temporarily paralyze the power of accommodation of the eye. Double vision may be observed. In the throat, it produces dryness and choking sensations, and this is one of the first effects of its toxic action. The skin is also dry, the face flushed, and the surface-temperature increased 1° or 2° F.

Upon the brain it has an exhilarating effect, and a talkative delirium of mild form may appear. In some cases the delirium is of a violent type. Subsequently, sleep usually occurs. In the lower animals (frogs) atropine produces arrest of breathing, followed by convulsions. The transient flushing, or erythema, which appears after its use, is probably due to its effects upon the sympathetic system, as a stimulant. In some instances it produces a rash, which closely resembles that of scarlet fever and which may even be followed by desquamation. The influence of the drug upon the heart and circulation is believed to be indirect through the nervous system. Belladonna paralyzes the inhibitory filaments of the pneumogastric nerve, and, as a result, the heart, under the influence of the sympathetic plexus, runs at a rapid rate without being checked by the paralyzed pneumogastrics. The force of the heart's beat is also increased. Coincident with this, and as a result of its action upon the blood-vessels, arterial tension is increased. In toxic doses, however, blood-pressure is reduced. The contraction of the smaller vessels may be due to action upon the muscular fibres of the walls, or it may be secondary to the action upon the nervous system. Respiration becomes more rapid, owing to stimulation of the respiratory centre. Contradictory statements have been made in regard to the effect of belladonna upon the respiratory centre. Dr. David Cerna, as a result of experimental and clinical study, coincides with the observation of Reichert, that "atropine acts upon the respiratory function in two opposing ways, one (peripheral) tending to diminish, the other (central) tending to increase, the increase or the decrease of the respirations in the normal animal depending upon which one of these factors predominates."

The flow of urine is increased at first as the result of increased arterial tension, but there is no increase in the solid constituents of the urine. Larger doses decrease the quantity of urine, apparently by virtue of a paralyzing action on the terminations of the vagus, if we may accept the experimental results of Lazaro and Pitini.[1] The secretions generally are checked, notably those of the mouth and skin; the flow of milk is also arrested by it. Though intestinal secretion is at first diminished, it is, probably, subsequently increased, since the alvine evacuations become more frequent and more liquid

[1] *Archivio de Farm. e Terapia*; *v. Deutsche medizinal-Zeitung*, Feb. 3, 1898.

during the administration of belladonna. In small doses it stimulates to more rapid movement the muscular coat of the bowel. Belladonna is eliminated chiefly by the kidneys, but partly by the bowels. Like other alkaloids, atropine is, to a certain extent, destroyed by the liver.

Toxic Effects and Antidotes.—Poisonous symptoms occasionally appear as the result of the introduction into the system of a very small quantity, either by absorption, as stated, or by passing from the eye into the nose, and thence into the throat. In such cases nothing more serious occurs than dryness of the throat, dilated pupils, possibly an erysipelatous or erythematous eruption upon the skin, and some fever and restlessness. Larger doses cause thirst, dryness, and aching of the fauces; flushing, rapid pulse, and hurried breathing; without decided increase of temperature, followed by coma or convulsions and death. The physiological antagonists which may be employed as antidotes are morphine, physostigmine, muscarine, and jaborandi (or pilocarpine). McGowan reports a case in which two injections of 0.03 Gm. (or gr. $^1/_2$), of pilocarpine unquestionably saved life. Chloral-hydrate has also been used as an antidote. According to Binz, morphine is particularly serviceable in allaying the restlessness and mental excitement caused by belladonna. Failing respiration is combated by strychnine. External heat will be useful if a state of collapse occurs. Animal charcoal, fixed alkalies, and demulcents, followed by free evacuation of the stomach and bowels, may also be prescribed. The compound tincture of iodine is a chemical antidote, precipitating the atropine and rendering it inert.

Therapy.—Belladonna ointment, or the liniment of belladonna, may be used with good results in neuralgia and chronic rheumatism; also in local sweating. In the form of atropine it is a mydriatic, but is less used now than formerly, as it is liable to cause glaucoma. The solutions of atropine for ophthalmic practice, or for use hypodermically, should be freshly prepared and sterilized each time, in order to avoid the development of penicillium in the liquid, which destroys the alkaloid, besides giving us an infected solution. M. Berger advocates the combination of alkaloids, believing that in this manner the same effects may be obtained by smaller doses. As a mydriatic he employs:—

℞ Atropin. sulphat.,		
Duboisin. sulphat.	aa	29 Gm. or gr. ivss.
Cocain. hydrobromat.	2	Gm. or gr. xxx.
Aq. destillat.	90	c.cm. or fʒiij.—M.

In eye-practice, belladonna is used less frequently to dilate the pupil and relax the accommodation in order to facilitate examination of the eye and determine its refraction, than to prevent adhesions between the pupillary border of the iris and the lens, or to avoid protrusion of the iris through an ulcer of the cornea. According to the observation of Dr. George Carpenter, the instillation into the eyes of infants, though it may cause physiological symptoms, is unsatisfactory as regards its action upon the pupil, dilatation being generally very tardy and incomplete.

Some oculists consider atropine santonate as the best combination as a mydriatic, but atropine sulphate is the salt generally employed, in from 0.015 to 0.25 Gm. to 30 c.cm. (or gr. $^1/_4$-iv to fʒj). The same solution is beneficially used in treating diseases of the ear, pain from inflammation of the middle or external ear, or membrana tympani, or earache, being relieved by dropping it in warm, when necessary. (See also **Homatropine.**)

Rigidity of the os uteri during labor is said to be relieved by local application of belladonna ointment. The same preparation is useful in spasms of the neck of the bladder or of the sphincter ani, and in vaginismus. If rubbed upon the abdomen, the extract of belladonna is said to check the vomiting of pregnancy and to relieve other reflex disorders dependent upon the gravid uterus. In leucorrhœa dependent upon inflammation of the cervix uteri, belladonna, in association with tannic acid, is a soothing application and restrains discharge.

It relieves the pain of herpes zoster, and of irritable and malignant ulcers. It also is serviceable in painful hæmorrhoids and fissure of the anus. It checks the suppurative process in boils, and promotes the resolution of enlarged glands. For any local pain, the appended formula, known as Ludlow's ointment, is very useful:—

℞ Atropinæ sulphatis	.03	Gm. or gr. ss.
Aconitinæ	.10	Gm. or gr. iss.
Olei tiglii	.12	c.cm. or *m*ij.
Petrolati	31	Gm. or ℥j.

M. Sig.: To be used by rubbing in a piece about the size of an ordinary pea.

Belladonna ointment may be advantageously employed in the relief of inflamed joints. The following are also good combinations:—

℞ Ungt. belladonnæ	2	Gm. or ℥ss.
Adipis lanæ hydrosi	15.5	Gm. or ℥ss.
Cerati plumbi subacetat.	12	Gm. or ℥iij.
Ungt. zinci oxidi	15.5	Gm. or ℥ss.

M. et ft. ungt.
Serviceable in furuncle, abscess, carbuncle, and herpes zoster.

℞ Cocaine hydrochloridi	.32	Gm. or gr. v.
Ungt. belladonnæ	31	Gm. or ℥j.

M. et ft. ungt.
A good application in ulcerated carcinoma or sarcoma, irritable ulcers, etc.

The pupils and throat should be carefully watched when belladonna ointment is used upon open surfaces. Accidents, probably due to idiosyncrasy, sometimes follow the use of atropine solutions in the eye. In addition to the usual manifestation of belladonna poisoning, cellulitis of the eyelids and face, and epistaxis has been observed. In some persons the use of even perfectly neutral solutions of atropine proves markedly irritant to the conjunctiva and gives rise to what is known as "atropine conjunctivitis." It likewise acts as an irritant in certain cases of iritis, especially those occurring in rheumatic patients with posterior synechiæ. Its use requires great caution in glaucoma. In latent cases it may excite an acute exacerbation. In inflammatory glaucoma it increases intra-ocular tension. Belladonna is an excellent local remedy in intercostal neuralgia or pleurodynia, and in the chest-pains of phthisis. The liniment may be applied with friction, and is the more cleanly agent, but strapping the chest with belladonna plaster is generally more efficient in pleurodynia or neuralgia. The plaster usually affords considerable relief in irritable heart. The same preparation is effective in lumbago and myalgia. It may be spread upon the abdomen in uterine or ovarian neuralgia, or, in these affections, the agent may be employed according to the method of Trousseau. This consists in combining 0.065 to 0.13 Gm. (or gr. i-ij) of the extract with 0.38 to 0.50 Gm. (or gr. vi-viij) of tannic acid, and applying it to the cervix uteri upon absorbent

cotton, or introducing it into the vagina in the form of a suppository. This combination is often valuable in leucorrhœa:—

℞ Ext. belladonnæ foliorum ..... 1|60 Gm. or gr. xxiv.
Acidi tannici ..... 6| Gm. or ʒiss.
Olei theobromatis ..... q. s.
M. et ft. suppositoria no. xxiv.
Three or four suppositories may be used daily.

A suppository containing the extract of belladonna, alone or in union, with opium, is very valuable in dysmenorrhœa dependent upon spasm of the cervix uteri. Belladonna, locally applied, has the power of alleviating that perversion of sensibility known as paræsthesia, or pruritus. Hence, a lotion or ointment containing this agent may be successfully used in pruritus of the genitals, urticaria, and chronic eczema, attended with excessive itching. A prescription like the following may be written:—

℞ Betanaphthol ..... 1|30 Gm. or gr. xx.
Ungt. camphoræ,
Ungt. menthol. ..... aa 8| Gm. or ʒij.
Ungt. belladonnæ ..... 15|5 Gm. or ʒss.
M. et ft. ungt.

Or:—

℞ Acid. carbolici ..... 2| c.cm. or fʒss.
Linimenti belladonnæ ..... 60| c.cm. or fʒij.
Glycerini,
Aq. rosæ .....aa 120| c.cm. or fʒiv.—M.

The liniment of belladonna, applied several times a day, has a remarkable power in restraining local excessive sweating. A solution of atropine in equal parts of alcohol and chloroform, the strength being 1 per cent. (0.32 Gm., or gr. v, of the alkaloid to 30 c.cm., or fʒj, of menstruum), will sometimes, according to Bartholow, allay obstinate cerebral or reflex vomiting.

Instead of belladonna, atropine may be used in proper quantity in forming ointments and lotions. The following is an elegant ointment for use in chronic ovarian, uterine, or pelvic disease:—

℞ Atropin. sulphatis ..... |13 Gm. or gr. ij.
Ol. neroli ..... |37 c.cm. or *m*vj.
Ungt. aquæ rosæ ..... 15|5 Gm. or ʒss.
M. et ft. ungt.

It has been asserted that atropine oleate (made by dissolving 1 part of atropine in 30 parts of oleic acid and adding 50 parts of olive-oil) makes a suppository of far more uniform composition than when extract of belladonna is employed.

Belladonna is chiefly employed internally to alleviate pain, relax spasm, and check excessive secretion or morbid discharge. It is a valuable remedy in neuralgia, especially of the trifacial nerve, though other forms are frequently amenable to its influence. Anstie esteemed it superior to any other agent in neuralgia of the pelvic viscera. Belladonna is beneficially given by the mouth in dysmenorrhœa, especially if the disorder is due to spasm of the neck of the womb.

Atropine is often productive of the happiest results in gastralgia, enteralgia, and gastric ulcer. As neuralgia is often expressive of insufficient

nutrition and is generally associated with anæmia, a combination of belladonna with iron, strychnine, and other tonic drugs is frequently successful. A formula similar to the following has been widely used:—

℞ Ext. belladonnæ fol.		.25 Gm.	or gr. iv.
Quinin. sulphat.	1	.40 Gm.	or gr. xxij.
Ferri sulphat. exsic.		.50 Gm.	or gr. viiss.
Strychnin. sulphat.		.015 Gm.	or gr. $^1/_4$.
Oleoresinæ piperis		.012 Gm.	or gr. $^1/_5$.
Arseni trioxidi		.50 c.cm.	or *m*viiss.

M. et ft. pil. no. xv.
Sig.: A pill thrice daily.

For the relief of migraine, Trousseau was accustomed to administer 0.01 Gm. (or gr. $^1/_6$) of the extract of belladonna, every hour, until the symptoms vanished or vertigo made its appearance. The form especially amenable to this treatment is the congestive headache, in which the pain is of a dull, compressive character, made worse by stooping over, with swelling of the face and throbbing of the temporal arteries, aggravated by noise; by movement of the body, efforts to read, or any intellectual exercise. In such cases the combined action of belladonna with a purgative like podophyllin or aloin is especially effective. The tincture or fluid extract of belladonna, or atropine sulphate, is useful in relieving the spasm of laryngismus stridulus, hiccough, spasm of the œsophagus, or local convulsive manifestations of hysteria. Intestinal, hepatic, or renal colic is ameliorated by this remedy. Belladonna is likewise of service in lead colic. A combination of atropine and potassium iodide is recommended as possessing decided efficacy in the treatment of plumbism. Belladonna has also been successfully employed for the relief of strangulated hernia, 0.015 Gm. (or gr. $^1/_4$) of the extract being given hourly, spontaneous reduction occurring after administration of four to six doses.

Atropine in doses of from 0.001 to 0.0045 Gm. (or gr. $^1/_{70}$-$^1/_{14}$) has been successfully employed by Dr. Batsch, of Grossenhain, in cases of intestinal obstruction where the symptoms were subacute or where there was necessity to temporize. In some cases a single injection sufficed to produce an evacuation, followed by recovery. In others, the injection resulted only in the escape of flatus and a small quantity of fæces, definite relief only following a second injection on the next day.

Belladonna is of service in epilepsy, but needs to be given persistently in gradually-increasing doses for a long period of time. It is particularly applicable to the *petit mal* or nocturnal epilepsy and to anæmic subjects. Wachenheim reports a case of the treatment of epilepsy with combined usage of atropine and potassium bromide. He considers epilepsy in idiopathic cases as due to an autointoxication, producing an abnormal irritation on the part of the cortical cells. According to his theory, the mechanism of the treatment is as follows: The bromides diminish the sensibility of the cortical cells, which have become hyperæsthetic to variations in the blood-supply; atropine stimulates the vasomotor centres, thereby making the blood-supply more uniform. In the early stages of treatment bromides are useful to dull the irritability of the cortex until the proper vascular tonus is established. When that point has been reached, they are of less importance, and may be reduced or withdrawn. Neither the bromides nor atropine can in any way meet the causal indication. If the disease depends on a passing intoxication, these

drugs will suspend the destructive action of the epileptic seizures until the *materia peccans* has ceased to act; if there is a permanent cause, as seems to exist in the majority of cases, such treatment will naturally be at best only a palliative. Belladonna is one of the most esteemed remedies for whooping-cough. It should be exhibited in sufficiently large doses to produce dilatation of the pupils, and is generally well borne by children in proportionately large doses:—

℞ Tinctura belladonnæ fol.	3	c.cm. or *m*l.
Vin. ipecacuanhæ	1	c.cm. or *m*xv.
Syr. tolutani	q. s. ad 60	c.cm. or f℥ij.

M. Sig.: Give a teaspoonful every hour to a child five years of age until relieved or physiological effects are observed, and then continue every three or four hours with same or half the quantity.

Belladonna is sometimes of signal service in spasmodic asthma. The most advantageous method of administration is that proposed by Dr. Salter, 0.65 c.cm. (or *m*x) of the tincture being repeated every two or three hours until disturbance of vision occurs or relief is obtained. The paroxysm may likewise be alleviated, though less certainly, by smoking belladonna-leaves in a pipe, or made into a cigarette. The tincture of belladonna is capable of affording marked benefit in exophthalmic goitre. When nocturnal incontinence of urine is caused by spasmodic contraction of the bladder, the fluid extract of belladonna is the best remedy which can be employed. The same treatment may be of avail in the incontinence of the aged. Atropine sulphate possesses considerable efficacy in spermatorrhœa and prostatorrhœa. It is best given at bed-time. Torticollis and muscular cramps are generally ameliorated by belladonna. Precordial pain and overaction of the heart are relieved by the internal use of belladonna. This drug enters very serviceably into remedies for habitual constipation. In disease of the kidney it relieves congestion by its action on the arterioles. In typhoid and typhus fevers, Dr. John Harley has derived decided advantage from the use of belladonna, which cleans and moistens the tongue and quiets the brain. Inflammation of the pharynx and tonsils is lessened by the use of belladonna, which may, with great utility, be combined with aconite and given in a solution of potassium chlorate. A suitable prescription may be thus formed:—

℞ Potass. chloratis	5 | 20	Gm. or gr. lxxx.
Acid. hydrochloric. dil.	6	Gm. or f℥iss.
Tr. aconiti	1	c.cm. or *m*xvj.
Tr. belladonnæ fol.	2	c.cm. or f℥ss.
Infus. rhois glabræ	q. s. ad 120	c.cm. or f℥iv.

M. et ft. sol.
Sig.: Tablespoonful every third hour.

On account of its marked influence upon the throat, belladonna has been used in scarlatinal angina. Much has been written concerning its value as a prophylactic in scarlatina, but in the experience of the author no reliance can be placed upon the drug as a preventive of that disease. It possesses some virtue as an internal remedy in erysipelas, and in this affection also is usefully given in conjunction with aconite, especially if much fever and delirium are present. It is sometimes able to check the vomiting of pregnancy. Aphonia due to fatigue of the cords soon disappears under the use of atropine. Belladonna is useful in allaying nervous cough, and, according

to Bartholow and Fothergill, has an excellent effect in caseous pneumonia, provided it be given in the stage of deposit before softening has taken place. Small doses of belladonna or atropine three or four times a day check the profuse discharge of mercurial ptyalism. Prof. H. Köbner, of Berlin, finds that the administration of belladonna facilitates the treatment of certain affections of the mouth, as leukoplakia, mucous patches, syphilitic ulcerations, etc., as it restrains salivation and the consequent rapid removal of the slough produced by the caustic. He usually gives the extract of belladonna dissolved in water, but atropine pills may be used with equal advantage.

The free sweating which occurs in weakly children, after slight exertion or during sleep, is suppressed by belladonna. The copious watery discharge of the first stage of acute coryza is controlled by atropine, which is one of the best remedies also in the night-sweats of phthisis, given at bed-time in the dose of 0.0008 to 0.001 Gm. (or gr. $^1/_{80}$-$^1/_{60}$). The free discharge of chronic bronchitis is restrained by belladonna. Colliquative diarrhœa is arrested by this remedy, according to M. Delpage. In certain cases of metrorrhagia, which had proved unamenable to other remedies, the hypodermic injection of the atropine sulphate, in the dose of 0.0003 Gm. (or gr. $^1/_{200}$) twice daily, has been attended with complete success. Hæmoptysis has also been controlled in the same manner. Atropine is useful in ulcer of the stomach when accompanied by hyperacidity. The remedy is beneficial in hyperæmic and inflammatory conditions of the brain or cord. Liégeois and other writers warmly recommend the internal administration of belladonna in chronic urticaria. Atropine sulphate is a valuable agent for diminishing the effect of shock. It may be given, in the dose of 0.0006 or 0.0008 Gm. (or gr. $^1/_{100}$-$^1/_{75}$), hypodermically, after a severe injury or prior to a surgical operation. Sir Lauder Brunton suggested that the hypodermic injection of atropine may prove of service in the algid stage of cholera, and cited the case of a child who recovered apparently as a result of this treatment. Great caution should be observed in employing this method, for, as pointed out by Professor Manasseïn, with the revival of the circulation and absorbent capacity, toxic manifestation might very readily be produced. In many cases it is advisable to inject atropine into the affected tissues (parenchymatous administration). In deep-seated neuralgia of large trunks, as, for instance, in sciatica, the most rapid relief is obtained by this method. In sciatica and myalgia it is a good plan to combine a small quantity (0.008 Gm., or gr. $^1/_8$) of morphine sulphate with the atropine solution for subcutaneous injection. The effect of each alkaloid is heightened by the combination. Dr. I. L. Van Zandt[1] uses atropine sulphate, 0.001 Gm. (or gr. $^1/_{60}$), hypodermically in the algid state of pernicious malarial fever. If no decided effects are produced in twenty or thirty minutes, the dose is repeated. As a synergist for the atropine he gives strychnine sulphate, 0.002 to 0.003 Gm. (or gr. $^1/_{30}$-$^1/_{20}$). Stirling has found the hypodermic use of 0.0004 Gm. (or gr. $^1/_{150}$) of atropine valuable in a case of hæmorrhage from the lungs. In tic douloureux, likewise, atropine thrown under the skin is especially useful.

Moretti recommends the hypodermic injection of atropine in paralysis agitans. Ostermayer esteems the same procedure as a valuable sedative and indirect hypnotic in the treatment of insanity. Massey has obtained good results in angina pectoris from the subcutaneous injection of atropine com-

[1] *Merck's Archives*, April, 1901.

bined with morphine. Leszynsky has reported the successful employment of hypodermic injections of atropine in a case of muscular torticollis, which was probably due to the influence of lead, as the patient was a painter. Various remedies, including electricity, had been used without effect. In torticollis excited by other causes the same procedure is of advantage. Some writers are of the opinion that belladonna retards the growth, as well as lessens the pain, of cancers, and promotes the absorption of enlarged lymphatic glands. Atropine is serviceably employed as an antagonist to a number of powerful vegetable poisons, as opium, morphine, physostigma, agaricus muscarius, etc.

BENZALDEHYDUM (U. S. P.).—**Benzaldehyde, Synthetic Oil of Bitter Almond.** (See **Amygdala Amara**, page —).

BENZANILID. — **Phenylbenzamid** is a white powder, which melts at 321.8° F., is insoluble in water, soluble in alcohol, and, with difficulty, in ether. In chemical composition it is closely allied to acetanilid. It is without odor and has a slightly caustic taste. It is given in single doses of 1 Gm. (or gr. xv), and from 4 to 6 Gm. (or ʒi-iss) may be administered in the twenty-four hours. Though at first well borne in these amounts, intolerance is generally manifested after several days' use.

Physiological Action.—Benzanilid depresses febrile temperature. Its effects are manifested from half to one hour after exhibition; the maximum is reached in four or five hours; the temperature then begins to ascend, and reaches its original height in ten to twelve hours. Respiration is not usually affected, though occasionally it is hastened. The pulse is rendered more slow and soft. Benzanilid produces no alteration in the quantity or reaction of the urine, but communicates to that fluid a greenish or even blackish color. After having been used continuously for several days it gives rise to pallor of the face and cyanosis of the mucous membrane. Dr. Luigi Cantu, of Pavia, states that it appears to have a cumulative effect.

Therapy.—The activity of benzanilid seems to be limited to the reduction of temperature, having no influence upon the course of the disease. It has been given in typhoid fever, rheumatism, pneumonia, neuritis, sciatica, malaria, etc. Dr. Cantu did not perceive any good effects from its use in chorea, neuritis, and sciatica. It exerted no favorable influence in malaria. It relieved the pain of acute rheumatism, but did not prevent extension of the disease to other joints.

BENZINUM (U. S. P.).—**Petroleum Benzin.**

BENZINUM PURIFICATUM (U. S. P.).—**Purified Petroleum Benzin.**
Dose, 0.60 to 2 c.cm. (or *m*x-fʒss), in mucilage or capsule.

Pharmacology.—A purified distillate from American petroleum, consisting of hydrocarbons (C_5H_{12} and C_6H_{14} and homologous compounds), chiefly of the marsh-gas series, and having a specific gravity of from 0.638 to 0.660, and boiling at 45° to 60° C. (113° to 140° F.). Benzin, or petroleum-ether, is a clear, colorless, diffusive liquid, yielding inflammable vapors, which, when mixed with air, are explosive; it, therefore, should be kept in well-stoppered bottles, or tin cans, in a cool place, remote from lights or flame. It is soluble in alcohol, ether, and oils, but insoluble in water. Fats, resins, and caoutchouc are dissolved by it.

Physiological Action.—Benzin resembles oil of turpentine in its local effects, especially when applied with friction. It is likewise an irritant when swallowed, but does not cause vomiting nor diarrhœa. It produces intoxication, faintness, headache, palpitation, or convulsions, which may end fatally; death may also be caused by gastro-enteritis, though relatively large amounts have been taken and the poisonous action overcome. The treatment should be directed toward evacuating the stomach and bowels, and counteracting the effects of the agent by diffusible stimulants and atropine, or ether, hypodermically.

Therapy.—Externally, benzin is used as a counter-irritant, applied upon a flannel bandage, or with friction, for neuralgic or rheumatic pains, but its odor is penetrating and unpleasant. Locally, benzin has been used as a dressing for wounds and ulcers. The addition of 2 per cent. of menthol makes it a local anæsthetic. Its action must be carefully watched, however, as it has been known to cause extensive blistering and death from exhaustion. Internally it is not used in medicine, although it is a domestic remedy for lumbricoid worms and tænia. It is claimed to be a good parasiticide in itch and pediculosis. (See **Petroleum.**) Benzin has been employed with success in the treatment of trichinosis, and is thought by Dr. Putter, from an experience with twenty-seven persons who had eaten trichinous pork, to possess prophylactic virtues against this species of poisoning. Benzin has been administered by inhalation with asserted advantage in whooping-cough. It has recently been used for producing anæsthesia in Schleich's method, which employs a combination or mixture of ether, chloroform, and benzin. It has been shown, however, that the benzin has decided toxic effects, and that patients, sometimes, show a tendency to rapid collapse, requiring artificial respiration to prevent a fatal accident.

BENZOINUM (U. S. P., B. P.).—**Benzoin.**

Preparations.

Adeps Benzoinatus (U. S. P.).—Benzoinated Lard (2 per cent.).

Tinctura Benzoini (U. S. P.).—Tincture of Benzoin. Dose, 2 c.cm. (or f3ss).

Acidum Benzoicum (U. S. P., B. P.).—Benzoic Acid. Dose, 0.32 to 1 Gm. (or gr. v-xv).

Tinctura Benzoini Composita (U. S. P., B. P.).—Compound Tincture of Benzoin (U. S. P. contains benzoin, 12 Gm.; aloes, 2 Gm.; storax, 8 Gm.; Tolu, 4 Gm.; alcohol, q. s. ad 100 c.cm.). A number of old remedies resembled it in composition, such as Turlington's balsam, Friar's balsam, Jesuit's drops, etc. Dose, 2 to 7.5 c.cm. (or f3ss-ij).

Trochiscus Acidi Benzoici (B. P.).—Benzoic-Acid Lozenge (0.03 Gm., or gr. ss, of benzoic acid in each, with fruit basis).

Adeps Benzoatus (B. P.).—Benzoated Lard (benzoin, 15 Gm.; lard, 500 Gm.).

Ammonium and Sodium Benzoates are official in both pharmacopœias, lithium benzoate in the U. S. P. only.

Pharmacology.—Benzoin is a balsamic resin obtained from Styrax Benzoin, and from another unknown species of Styrax (Styraceæ). The best quality is in light lumps or tears, but it also occurs in large masses. It contains, besides resin and a volatile oil, from 14 to 20 per cent. of free benzoic and cinnamic acids, the latter in small proportion. It also contains **Styracin,** 2 to 3 per cent., some vanillin, styrol, and benzaldehyde, with phenol-propyl cinnamati, 1 per cent., and 75 per cent. of the cinnamic esters of benzoresinol

and resinotannol. The latter yield about one-third their weight of cinnamic acid. **Benzoic Acid** is in white, lustrous scales, or friable needles, permanent in air, having a slight, aromatic odor of benzoin; a warm, acid taste; and an acid reaction. It is soluble in 500 parts of water, 15 of boiling water, 3 of alcohol, or 1 of boiling alcohol, in fixed oils and alkaline solutions. Benzoic acid melts at 250° F. It forms neutral salts with the alkalies.

It is volatilized by heat. Two other sources of the benzoic acid of commerce are known: it is a derivative of toluol and also of hippuric acid, the hippuric acid being derived from the urine of horses and cattle. The benzoic acid may retain some traces of its source, and, therefore, the pharmacopœia directs that it shall smell of benzoin. Benzoin prevents fat from becoming rancid, and hence it is, in small quantity, a useful addition to ointments, for which the benzoinated lard is a good basis.

Physiological Action.—In solution in the form of the tincture, benzoin is protective to excoriated surfaces, and, like other gums, is antiseptic. After absorption it has a stimulating effect upon mucous membranes; part of it is decomposed in the system to form hippuric acid, and, being excreted by the kidneys, increases the acidity and the quantity of the urine. Benzoic acid has some power in preventing the growth of bacteria, possessing the advantage over carbolic acid of being non-poisonous. Sodium benzoate has a stimulating effect upon the liver, and, according to the experiments of Carl Virchow, increases nitrogenous elimination from the kidneys. Benzoic acid, or sodium benzoate, inhaled or taken internally, may, in exceptional instances, give rise to an erythematous, or small papular, eruption. In some cases of idiosyncrasy, urticaria may be produced.

Therapy.—The tincture, especially the compound tincture, is used to paint over abrasions and excoriations in order to protect the surface, particularly in cases of tender nipples. It may also be painted on the skin for chilblains after bathing the surface with 5-per-cent. solution of carbolic acid. It was formerly employed as a dressing for ulcers. As an expectorant, we may give tincture of benzoin in chronic bronchitis. The official camphorated tincture of opium (paregoric elixir) contains benzoic acid. In troublesome cough, the combination with opium is necessary, although the opium checks secretion and expectoration; a better combination would be:—

℞ Codeinæ ..... 0.38 Gm. or gr. vj.
Acidi benzoici ..... 15.0 Gm. or ʒiv.
Syr. tolutani,
Aquæ camphoræ ..... aa 90.0 c.cm. or fʒiij.
M. Sig.: Take a dessertspoonful every four hours.

Inhalations of steam impregnated with the compound tincture of benzoin are beneficial in acute and chronic laryngitis. Morell Mackenzie used a vapor of the compound tincture of benzoin, 1 teaspoonful to a pint of water at 140° F., inhaled frequently, for acute laryngitis.

The following gargle is recommended in pharyngitis:—

℞ Sodii benzoat. ..... 0.65 Gm. or gr. x.
Tinct. benzoin. ..... 2.0 c.cm. or fʒss.
Infus. rosæ fol. ..... 15.0 c.cm. or fʒss.—M.

Sodium benzoate is also used with advantage in chronic diarrhœa and dysentery. In 0.65 to 2 Gm. (or gr. x-xxx) doses it is very useful in liver disorders, likewise in chronic indigestion dependent upon inactivity of the

liver and accompanied by an abundant excretion of uric acid. This salt is also of service in septic and febrile diseases, in doses of 8 to 15.5 Gm. (or 3ii-iv) daily (Senator). Owing to its solubility, it is preferable to benzoic acid, and is equally as efficient in acute rheumatism. In scarlet fever and small-pox, sodium benzoate reduces the temperature and mitigates the severity of the disease. This salt has proved very useful in the treatment of diphtheria, administered internally, and at the same time applied by insufflation to the seat of the lesion. Its employment has seemed to be attended with good results in typhoid fever and whooping-cough. The same remedy in the form of a spray has been extolled in phthisis, but it has no such decided effect upon the tubercle bacilli as had been hoped. Benzoic acid, in daily doses of 10 to 12 Gm. (or 3iiss-iij), has been found of service in acute rheumatism, but is inferior to salicylic acid. In erysipelas, benzoic acid has been given with reported good results. It is of advantage in the treatment of chronic bronchitis.

In its exit from the system this acid acts as a gentle stimulant and local antiseptic to the bladder and urethra. In chronic cystitis with fermentation of urine and deposit of phosphates, benzoic acid is extremely useful, reducing the alkalinity of the fluid and the irritability of the bladder. For similar reasons it sometimes proves of service in chronic gonorrhœa, in obstinate irritation of the urethra due to the condition of the urine, and in incontinence caused by an alkaline reaction of the urine. In all these conditions sodium or ammonium benzoate may be used instead of the acid. Benzoic acid promotes the solubility of gravel, whether composed of urates or phosphates. A favorite formula of Dr. Golding-Bird was:—

℞ Sodii carbonatis	6	Gm.	or 3iss.
Acid. benzoici	2 60	Gm.	or gr. xl.
Sodii phosphatis	12	Gm.	or 3iij.
Aq. ferventis	120	c.cm.	or f℥iv.

Solve et adde:—

Aq. cinnamom.	225	c.cm.	or f℥viiss.
Tr. hyoscyami	15	c.cm.	or f3iv.

M. Sig.: Two tablespoonfuls three times a day.

In uræmic conditions, and what has been called lithæmia, lithium benzoate has a most happy effect, carrying off the excess of uric acid and urates, acting also as a diuretic. Even in albuminuria, the benzoates have been used with advantage, especially calcium benzoate.

Freckles may be removed by the topical application of tincture of benzoin, containing corrosive chloride of mercury:—

℞ Hydrarg. chlor. corros.	03	Gm.	or gr. ss.
Tincture benzoini	9 25	c.cm.	or f3iiss.
Glycerini	7 50	c.cm.	or f3ij.
Aquæ rosæ	180	c.cm.	or f℥vj.

M. Sig.: Use as a lotion to affected spots.

The above may also be used in pityriasis versicolor, or moth-spots, and chronic urticaria. The compound tincture of benzoin is sometimes able to relieve the itching of urticaria and eczema. A solution of benzoic acid in cologne-water makes a pleasant application, frequently successful in urticaria. Mixed with an equal quantity of glycerin, the tincture or the com-

pound tincture is useful in chapped lips and hands. The compound tincture is a good styptic, and yields excellent results when injected into old sinuses. It disinfects the tract, and promotes healing. Benzoic acid is an efficient antiseptic application to unhealthy wounds and ulcers.

As a dentifrice, Professor Miller recommends:—

℞ Acid. thymici		25 Gm. or gr. iv.
Acid. benzoici	3	Gm. or gr. xlv.
Tr. eucalypt. fol.	15	c.cm. or fʒss.
Alcohol. absolut.	90	c.cm. or fʒiij.
Ol. gaultheriæ	1	55 c.cm. or gtt. xxv.

M. Sig.: A teaspoonful or two in half a glass of water, as a mouth-wash.

Bismuth benzoate is an excellent dressing to chronic, unhealthy, or sloughing ulcers, chancroids, open buboes, chancres, and ulcerated lesions of late syphilis. It is usually applied in the form of a powder, the surface having previously been thoroughly cleansed by a weak solution of corrosive sublimate or hydrogen dioxide.

BENZOL (B. P.).—**Benzol** or **Benzene.** Phenyl hydride.

Pharmacology.—A mixture of homologous hydrocarbons obtained from light coal-tar oil. It contains about 70 per cent. of benzene (C_6H_6) and 20 to 30 per cent. of toluene ($C_6H_5CH_3$). This is distinct from and should not be confounded with benzin obtained from petroleum. It is a thin, colorless fluid, very volatile and inflammable, and has an aromatic, not very unpleasant, odor. It is almost insoluble in water, but dissolves in four parts of alcohol. It may be obtained by distilling a mixture of benzoic acid with lime, or by fractional distillation from naphtha: a derivative of coal-tar.

Physiological Action.—Benzol is antiseptic and antiparasitic, with but little local action beyond the extraction of oily matters from the skin. Owing to its solvent action upon many alkaloids, it might be useful in local medication by enabling the remedy to penetrate the skin. Taken internally, benzol produces intoxication, anæsthesia, and coma.

Therapy.—It has been given in a few drop doses as a remedy for dyspepsia, and also in trichinosis. It is employed in pharmacy as a solvent, but is not often administered, or employed in practical medicine. Dr. A. Da Socca has used, locally, with alleged good results, a mixture of 1 to 6 of tincture of iodine and benzol in diphtheria. Benzol has been advantageously given in whooping-cough by Dr. Robertson, in doses of 0.12 c.cm. (or *m*ij) in mucilage to children six months of age. The same writer reports good results from the use of benzol in influenza. He administered it in the form of an emulsion in lemonade, 0.30 c.cm. (or *m*v) at a dose, repeated every three hours. It was always well tolerated. It had the effect of reducing temperature and relieving the general discomfort. Convalescence was generally rapid.[1]

Nitrobenzol.—This product, known commercially as the oil of mirbane, or artificial almond-oil, is used extensively in the manufacture of dyes, perfumery, and explosive compounds. Cases of acute or chronic poisoning follow the absorption of nitrobenzol. The workmen subjected to its influence frequently suffer from a train of symptoms which have been studied by Dr. Prosser White. The usual manifestations are sleepiness, headache, languor, and a severe form of anæmia. There is a decided loss of weight, the appetite

[1] *London Lancet*, Nov. 11, 1893.

becomes capricious or altogether fails, nausea and vomiting may occur, the urine becomes darkened in color and contains aniline. The temperature of the body is slightly raised, but the extremities become very quickly chilled. There is excessive waste of the muscles, especially those of the extremities. Hyperæsthesia is a characteristic symptom. Sensation in the extremities may be slightly impaired. The sexual appetite is weakened or lost. The reflexes are generally enfeebled. The eyes are not usually affected, though nitrobenzol may produce a peculiar form of retinitis, with great defect of sight. The pulse is feeble and thready, arterial tension is low, the blood is chocolate-colored or black. The corpuscles are decreased. No direct antidote is known. It is said that, when taken into the stomach, nitrobenzol may remain for some time unabsorbed, and an emetic or the stomach-pump will, therefore, be of service. A saline cathartic is also advisable, but oils, fats, and alcohol are not recommended. Counter-irritation to the chest, friction of the limbs, and ammonia as a stimulant may be employed. Artificial respiration is of avail. Dr. White states that 1 c.cm. (or *m*xv), taken by the mouth, has caused death. Letheby and Filehne give the fatal dose as varying from 0.12 to 7.5 c.cm. (or *m*ii-f℥ij). A case has, however, been reported by Dr. E. Cissel, of Vienna, in which a woman, it is stated, took nearly 105 c.cm. (or f℥iiiss) of nitrobenzol and yet recovered. The symptoms were deep cyanosis, superficial respiration, small pulse, and dribbling of urine, which contained the toxic agent. Camphor injections were administered and artificial respiration was practiced. Consciousness returned and recovery followed; on the fourth day the urine resembled that of a case of cystitis.

BENZOSULPHINIDUM (U. S. P.), **GLUSIDUM** (B. P.), or **Saccharin.** Anhydro-ortho-sulphamine-benzoic acid ($C_7H_5NO_3S$) is a coal-tar derivative, discovered in Professor Remsen's laboratory of Johns Hopkins University, and first described by C. Fahlberg in 1879. It is a sweet imide derived from toluene (B. P.). It is a white, crystalline powder, with an acid reaction, but an intensely-sweet taste. Its odor, which becomes stronger on warming, is faintly suggestive of nitrobenzol. This substance is soluble in 500 parts of cold water, readily soluble in alcohol and ether. Saccharin dissolves also in glycerin. Its solubility in water is promoted by the addition of sodium bicarbonate in the proportion of 2 parts to 3 of saccharin. Commercial saccharin may contain a large number of impurities. Pure saccharin can be separated from the mixture by means of ether. Dose, 0.13 to 0.32 Gm. (or gr. ii-v).

Saccharin forms soluble salts with the hydrates of carbonates of the alkaline metals. It melts at 220° C. (428° F.), and when fused with potassic hydrate it forms salicylic acid. One part dissolved in 70,000 parts of water imparts to the solution a distinctly-sweet taste; it is about 300 times sweeter than cane-sugar, which it resembles in taste, except for a peculiar slight flavor of bitter almonds.

Physiological Action.—Saccharin is excreted by the kidneys unchanged; it is not decomposed in the body, and has little if any effect upon digestion, though the experiments of C. T. Fox have demonstrated that, when added to food, saccharin checks the action of saliva upon starch.

The only noticeable effects upon the urine are that it does not so readily undergo fermentation, and the chlorides are slightly increased. Pure saccharin is not possessed of toxic or deleterious effects upon the human

organism, even in doses as large as 5 Gm. (or gr. lxxv). Saccharin has considerable antiseptic virtue, which, according to Constantine Paul, is impaired when it acts in an acid medium.

Therapy.—Saccharin is chiefly employed to take the place of sugar in the diet of obese and diabetic patients. For this purpose it is best prescribed in the form of a syrup containing 10 parts of saccharin and 12 parts of sodium bicarbonate in 1000 parts of distilled water, made with gentle heat at 40° C. (104° F.). It has also been claimed by Dreschfeld that saccharin relieves some of the symptoms of acid dyspepsia. Dr. James Little asserts that saccharin freely administered is an efficient remedy in chronic cystitis with ammoniacal urine. Two parts of saccharin dissolved by means of 3 parts of sodium bicarbonate are said to form an excellent tooth-wash. Fournier has found a mouth-wash containing saccharin efficacious in aphthæ. By Dr. Felici, of Rome, it has been utilized as an application in ozæna. The crusts having been removed by vaselin-oil and the cavity cleansed with a saline fluid, a solution containing from 0.50 to 1 Gm. (or gr. vii-xv) of saccharin is applied twice daily to the affected parts. The remedy was especially useful in cases where there was atrophy of the turbinated bones and mucous membrane and in those characterized by the odor and discharge of ozæna without apparent anatomical changes.

Saccharin is largely used in confectionary to add to glucose and make it correspond more closely in sweetness with cane-sugar. It may be combined with quinine, in order to overcome the bitterness:—

℞ Quinin. sulphat.	4	Gm. or 3j.
Saccharin.	2	Gm. or gr. xxx.

M. et div. in chartulæ no. xxx.

Sig.: Take one four times a day.

BERBERIS (U. S. P.).—**Barberry.**

Preparation.

Fluidextractum Berberidis (U. S. P.).—Fluid extract of Berberis. Dose, 0.10 to 0.30 c.cm. (or *m*ii-v).

The rhizome and roots of the Oregon grape, or Berberis aquifolium, or of other species of Berberis (Berberidaceæ). It contains an alkaloid, **Berberine,** which also exists in Hydrastis.

Berberis is tonic and diuretic, and is believed to act as an alterative, making it valuable for the treatment of blood diseases, dyspepsia, hepatic disorder, habitual constipation, and skin diseases dependent upon unhealthy secretions or conditions of the digestive tract. Vehsemeyer claims to have produced decided improvement, in the case of an infant afflicted with leukæmia, by the administration of berberine sulphate. Berberis has been topically employed in conjunctivitis, and the berberine hydrochlorate has been used with advantage as an injection in gonorrhœa. Internally, berberine or its hydrochlorate may be given, in doses of 0.015 to 0.32 Gm. (or gr. $^1/_4$-v).

BETANAPHTHOL (U. S. P.).—**Betanaphthol; Naphthol** (B.P.). (See **Naphthol.**

BISMUTHUM.—Bismuth.

Preparations.

Bismuthi Citras (U. S. P.).—Bismuth Citrate. Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Bismuthi et Ammoniæ Citras (U. S. P.).—Bismuth and Ammonium Citrate. Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Bismuthi Subcarbonas (U. S. P.).—Bismuth Subcarbonate. Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Bismuthi Subnitras (U. S. P., B. P.).—Bismuth Subnitrate. Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Bismuthi Carbonas (B. P.).—Bismuth Oxycarbonate. Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Bismuthi Salicylas (U. S. P., B. P.).—Bismuth Salicylate. Dose, 0.065 to 1.30 Gm. (or gr. i-xx).

Bismuthi Subgallas (U. S. P.).—Bismuth Subgallate. Dose, 0.3 to 1.30 Gm. (or gr. v-xx).

Bismuthi Oxidum (B. P.).—Oxide of Bismuth. Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Liquor Bismuthi et Ammonii Citratis (B. P.).—Solution of Bismuth and Ammonium Citrate, or Liquor Bismuthi (0.05 Gm. in 1 c.cm., or gr. iij of bismuth oxide in f3j). Dose, 2 to 4 c.cm. (or f3ss-j).

Trochiscus Bismuthi Compositus (B. P.).—Compound Bismuth Lozenge (bismuth oxycarbonate, magnesium carbonate, heavy, of each, 0.13 Gm., or gr. ij; precipitated calcium carbonate, 0.25 Gm., or gr. iv, with rose basis).

Pharmacology and Physiological Action. — Bismuth in the metallic form is not official, and has no medical interest. Its salts, however, are of great value, the insoluble ones differing greatly in their applications from those which are soluble. The **subnitrate** and **subcarbonate** are, or should be, in the form of white, impalpable powder, which has a slight astringent and absorbent action when dusted upon excoriated or ulcerated surfaces. The free use of subnitrate of bismuth as a dressing for wounds or ulcers may lead to absorption and poisoning. Among the consequences are acute stomatitis, and a dark discoloration of the gums, spreading over the entire mouth, followed by diarrhœa and nephritis. Dr. F. P. Henry,[1] of Philadelphia, reports a fatal accident of this character. When taken internally, these salts have very much the same effect along the digestive tract as upon the surface of the body, checking excessive secretion and exerting a sedative influence. When injected under the skin, part of the salt is absorbed and poisoning may result. Or, if large doses are taken by the mouth, death may follow from gastro-enteritis, the symptoms being very much like those caused by gold, lead, and mercury. After death, bismuth is found in the liver and other viscera, and in the urine and saliva. A purplish line upon the gums, recalling that of lead, has been noticed. The treatment is by demulcents, washing out the stomach, and the administration of the antidotes to arsenic, with which native bismuth is usually combined. When the soluble preparations are given for a considerable time, the bismuth is apt to accumulate in the liver; but this is not likely to follow the administration of the insoluble salts. The solutions, or elixirs, purporting to contain bismuth in combination with pepsin, are unscientific and may be dangerous. The discharges from the bowels are blackened by bismuth. The tongue becomes coated with a slate-colored fur. The prolonged administration of bismuth subnitrate has been known to cause a large intestinal concretion. It may, under these circumstances, also give rise to sloughs in the mouth and gastro-intestinal canal, also to desquamative nephritis and albuminuria.

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[1] *Journal of the American Medical Association*, December 7, 1901.

Therapy.—In using bismuth it is essential that it shall be pure and free from arsenic. When well made, the subnitrate, or subcarbonate, is very useful as a dusting-powder for excoriated surfaces, and as a dressing after wounds or amputations; but when used freely has led to poisoning by absorption. However, it is valuable in small wounds and in some old ulcers. Combined with mucilage (4 Gm. to 180 or 240 c.cm., ℥j to ℥vi-viij), it is a good injection for gonorrhœa during the early stage; or it may be used as a soluble bougie, or as a vaginal suppository for leucorrhœa. The same preparation is likewise useful in ulcer of the rectum.

The addition of a small proportion of carbolic acid or acetanilid will enhance its antiseptic effect. In acne, intertrigo, and erythema in infants, or in vesicular eczema, the subnitrate, or subcarbonate, of bismuth may be lightly dusted over the surface. In the case of wounds, the red oxyiodide is preferred by A. Sidney Reynolds[1] to iodoform, as an antiseptic and also as an ointment in skin diseases. This salt is a local anæsthetic and antiseptic. It does not stain the skin or clothing, and may be employed as a dusting-powder or an ointment. It is an excellent application to chancre, chancroids, open buboes, ulcers, unhealthy wounds, and phlegmonous erysipelas. The following is a good combination:—

℞ Naphthalin	2	Gm. or ʒss.
Bismuthi subiodidi	4	Gm. or ʒj.
Unguenti simplicis	25	Gm. or ʒviss.

M. et ft. ungt. Useful upon chancres, chancroids, and syphilitic ulcers.

Subnitrate of bismuth in powder has been used with success in simple ozæna, snuffed into the nostrils, though it is inferior to other remedies. It may also be employed in aphthous or nursing sore mouth, and in mercurial ptyalism. It may be of service in chronic conjunctivitis and granular lids. Made into an ointment, it is an excellent application to chancroids, irritable ulcers, erysipelas, blisters, pemphigus after the bullæ have ruptured, leaving raw surfaces exposed, the erythematous and bullous forms of burns, and in the first stage of dermatitis. In these conditions an ointment may be thus composed:—

℞ Bismuthi subnitratis	2	Gm. or ʒss.
Pulv. marantæ	15	5 Gm. or ʒss.
Morphinæ sulphatis		20 Gm. or gr. iij.
Adipis lanæ hyd.	15	5 Gm. or ʒss.

M. et ft. ungt.

An ointment consisting of bismuth subnitrate and boric acid, with lanolin and olive-oil, is regarded by Wertheimer as particularly appropriate to the treatment of burns in children. An ointment containing the oleate of bismuth is also valuable in diseases of the skin. It may be prescribed as follows:—

℞ Ext. belladonnæ folior.		65 Gm. or gr. x.
Ext. opii	1	30 Gm. or gr. xx.
Ungt. bismuthi oleatis	15	5 Gm. or ʒss.

M. For furuncles, carbuncles, and eczema of the genitals.

The internal administration of insoluble bismuth preparations is principally based upon their local action upon the stomach and intestinal tract.

[1] *Medical News*, Oct., 1886.

They form a coating over the inflamed or irritated surfaces and keep them from coming in contact, while they also exert an astringent and sedative effect. In gastralgia, irritable stomach, and some dyspeptic conditions they are of much value:—

℞ Bismuthi subnitratis ..... 8| Gm. or 3ij.
Pepsini saccharati ..... 4| Gm. or 3j.
Creosoti ..... |24 c.cm. or *m*iv.

M. et div. in chartulæ no. xij.
Sig.: Give one every hour until relieved. (The oil of gaultheria may be substituted for the creosote, in case of children, and the powders made smaller.)

In painful dyspepsia and gastralgia, Dujardin-Beaumetz prescribed:—

℞ Bismuthi subnitratis,
Magnesiæ,
Cretæ præparatæ,
Calcii phosphatis ..... aa 10| Gm. or 3iiss.

M. et div. in chartulæ no. xl.
Sig.: One powder before each meal.

Bismuth may be given in powder also, as:—

℞ Bismuth. subnit.,
Magnesii carbonatis ..... aa 4| Gm. or 3j.
Morphinæ sulphatis ..... |065 Gm. or gr. j.

M. et ft. chartulæ no. xij.
Sig.: A powder every hour or two. Employ in gastralgia, dyspepsia attended with acidity, and in cancer of the stomach.

In half-grown children with irritable stomach, the result of improper feeding, a good combination is:—

℞ Bismuth. subnit. ..... 2| Gm. or 3ss.
Sodii bicarb.,
Pulv. rhei ..... aa |65 Gm. or gr. x.

M. et ft. chartulæ no. x.
Sig.: A powder every four hours.

The following liquid combinations of bismuth are likewise of service, especially in gastric catarrh and some varieties of dyspepsia:—

℞ Bismuth. citratis ..... 8| Gm. or 3ij.
Glycerini pepsinæ (B. P.)..... ..... 90| c.cm. or f℥iij.

M. Sig.: A teaspoonful before meals.

℞ Bismuth. subnit. ..... 8| Gm. or 3ij.
Pulv. rhei ..... 6| Gm. or 3iss.
Pulv. acaciæ ..... 8| Gm. or 3ij.
Spt. myristicæ ..... 7|50 c.cm. or f3ij.
Aquæ menth. pip. .....240| c.cm. or f℥viij.

M. Sig.: A tablespoonful in water every four hours.

The salicylate is a soft, white powder; insoluble in water, alcohol, ether, and chloroform, but soluble in acids. In gastro-enteritis, or summer complaint in young infants, the salicylate gives excellent results in small doses (0.065 to 0.13 Gm., or gr. i-ij). This combination is likewise valuable in the diarrhœa of typhoid fever, in which it is serviceably given with naphthol. Bismuth salicylate is useful for the purpose of securing gastric antisepsis in cancer of the stomach. It may be associated with betanaphthol or salol. This salt, also, is highly esteemed as a remedy in infantile diarrhœa.

Gastric ulcer is much benefited by the subnitrate in 0.65 to 1 Gm. (or gr. x-xv) doses, given every three hours, or oftener, if there is much pain. Where malignant ulceration is suspected, opium and belladonna may be administered at the same time. The vomiting of pregnancy may sometimes be relieved by bismuth subnitrate. It serves a useful purpose in the chronic gastritis so common in drunkards. In acidity of the stomach it is useful, and also in flatulent dyspepsia. A combination of bismuth with charcoal is efficacious in the latter condition, as:—

℞ Bismuthi subnitratis,
Pulveris aromatici ..... aa 8 | Gm. or ʒij.
Carbonis ligni (recentis) ..... 15 | 5 Gm. or ʒss.
M. et div. in chartulæ no. xij.

In diarrhœa, the subnitrate is usually a reliable remedy, but, as Ringer advises, it should be preceded by a dose of castor-oil, in order to remove fermenting material or other causes of irritation. In the diarrhœa of phthisis, it can be given in combination with pepsin or pancreatin. It may be given in hot milk to children; but it is almost tasteless, and may be placed at once upon the tongue and washed down with water or milk. In chronic diarrhœa, bismuth subnitrate not infrequently affords marked relief. An excellent prescription for diarrhœa, particularly when acute, is:—

℞ Bismuth. subnit. ..... 78 | Gm. or ʒiiss.
Pulveris myristicæ ..... 2 | 60 Gm. or ℈ij.
Aquæ cinnamomi,
Syrup. acaciæ ..... aa 60 | c.cm. or fʒij.
M. Sig.: Two teaspoonfuls every half-hour, or hour, until relieved.

In cases of infantile diarrhœa, when the stools are greenish, contain casein, and are accompanied by abdominal pain, Dr. Zinnès relies upon the following prescriptions:—

℞ Bismuth. subnitrat. ..... 3 | Gm. or gr. xlv.
Liq. calcis ..... 6 | c.cm. or fʒiss.
Syrup. aurant. ..... 15 | c.cm. or fʒss.
Aquæ fœniculi ..... 60 | c.cm. or fʒij.
M. Sig.: Teaspoonful every two hours.

℞ Bismuth. subnitrat. ..... 3 | Gm. or gr. xlv.
Syrup. aurant. ..... 15 | c.cm. or fʒss.
Infus. calumbæ ..... 60 | c.cm. or fʒij.
M. Sig.: One or two teaspoonfuls every two hours.

In epidemic dysentery, large doses of bismuth have been administered with benefit. Trousseau was accustomed to order bismuth injections in dysentery.

A solution of bismuth and ammonia citrate is official in the British Pharmacopœia. An extemporaneous formula may be used, like the following:—

℞ Bismuthi et ammoniæ citrat. ..... | 32 Gm. or gr. v.
Aquæ chloroformi ..... 15 | c.cm. or fʒss.
Elixir aurantii ..... 45 | c.cm. or fʒiss.
M. Sig.: Take 15 c.cm. (or fʒss) three or four times daily, for irritable stomach.

This double salt has been employed in the treatment of acute and chronic diarrhœa. P. Vigier has prepared a bismuth benzoate as a substi-

tute for the bismuth salicylate, or subnitrate. Bismuth benzoate contains 27 per cent. of benzoic acid, and may be advantageously used as an intestinal antiseptic, and is a preferable substance to the salicylate as regards its elimination by the kidneys.

Bismuth Subgallate, or Dermatol. — Under this name Drs. Heinz and Liebrecht have introduced a new combination which occurs in the form of a fine, saffron-yellow powder, odorless and innocuous; insoluble in water, alcohol, and ether; not hygroscopic or otherwise affected by exposure to air or light. It possesses astringent, antiseptic, and desiccant properties. This substance is also possessed of local anæsthetic power. It is of especial value in lesions attended by profuse secretion, as eczema, burns, ulcers, wounds, and diseases of the eye and ear. Dr. Eugene Doernberger reports excellent results from its use in pemphigus, herpes zoster, and abscesses of the skin occurring in children. Dermatol has been advantageously applied to chancroids and ulcerated chancres, to balanitis, varicose and other ulcers of the leg. Suspended in mucilage, it has been used as an injection in acute and chronic gonorrhœa. Mixed with an equal quantity of castor-oil, Grossman has employed it in the treatment of sore nipples. It is considered of value as a dressing to abdominal wounds and in perineoplasty. Tampons made of gauze impregnated with dermatol are of service in the treatment of vaginal catarrh. A powder composed of 20 parts of dermatol, 10 parts of starch, and 70 parts of talc is a good application in hyperidrosis of the hands and feet. Dermatol may be used pure as a dusting-powder, as a 25-per-cent. ointment, a collodion emulsion, and as a 10- to 20-per-cent. gauze.

Colasanti and Dutto report favorably of the internal employment of dermatol in different forms of diarrhœa, including that of typhoid fever and tuberculosis. It was given in daily doses of 2 to 3 Gm. (or gr. xxx-xlv) in divided portions. Dr. Austin Flint recommends bismuth subgallate in the treatment of fermentative dyspepsia. He has had excellent results from its use in chronic cases, giving 0.32 Gm. (or gr. v) in capsule or tablet before or after each meal. A number of loose combinations of bismuth have lately been introduced as antiseptic remedies. **Phenol-bismuth, cresol-bismuth,** and **betanaphthol-bismuth** are decomposed in the stomach, the phenol and cresol being absorbed and eliminated by the kidneys, while the bismuth is almost completely removed by the bowels. Naphthol is partly eliminated with the urine and partly through the intestine. In daily doses of 1 to 3 Gm. (or gr. xv-xlv) Dr. Jasenski, of St. Petersburg, gave phenol-bismuth with advantage in typhoid fever, acute and chronic gastric and gastro-intestinal catarrh, and in diarrhœa. **Tribromphenol-bismuth** is a yellow, insoluble powder, without odor or taste and almost free from toxic action. It contains 49.5 per cent. of bismuth oxide and 50 per cent. of tribromphenol. Professor Hueppe, of Prague, recommends it as a valuable agent in the treatment of Asiatic cholera. **Betanaphthol-bismuth** is a brown, odorless powder, insoluble in water, and containing 80 per cent. of bismuth oxide. In doses of 1 to 2 Gm. (or gr. xv-xxx) it acts as an excellent intestinal antiseptic. Both betanaphthol-bismuth and tribromphenol-bismuth are efficient remedies in fermentative dyspepsia, and chronic intestinal catarrh dependent upon the presence of micro-organisms. Dr. Reynold W. Wilcox has found the former compound to answer an excellent purpose in chronic membranous enteritis. Tribromphenol-bismuth possesses rather a sweetish taste, and shares the astringent properties of other compounds of bismuth.

Bismuth chrysophanate has been introduced under the name of **dermol.** It is an amorphous yellow powder of neutral reaction, insoluble in the ordinary menstrua. It is proposed for use, in the form of ointment, in diseases for which chrysophanic acid is employed.

Thioform is a combination of bismuth, sulphur, and salicylic acid, and occurs in the form of a light, grayish-yellow powder insoluble in water, alcohol, and ether. Thioform is devoid of odor or taste. It is comparatively free from toxic effects, and has been used with success upon burns, ulcers, and sloughing wounds. Dr. E. Fromm reports favorably concerning its action in conjunctivitis, purulent ophthalmia, and the strumous ophthalmia of children. Thioform has also been employed as a styptic in the operation of enucleating the eyeball.

Bismuth sulphite has been found useful by Cesaris and Racchetti as an intestinal antiseptic and anthelmintic. **Bismuth tannate** has been used internally as an astringent in diarrhœa in doses of 0.65 to 2 Gm. (or gr. x-xxx).

BOLDUS.—Boldo, or Peumus boldus (Monimiaceæ), is an evergreen belonging to the western coast of South America. The dried leaves and stems contain a bitter extractive, a volatile oil, and a bitter alkaloid (about 0.1 per cent), **Boldine.** A tincture (5 per cent.) is used in 0.30 c.cm. (or *m*v) doses or more, gradually increasing, and produces vomiting and purging in full doses, and also a sedative or narcotic effect upon the brain. In small doses it is carminative and stimulant to the stomach.

Therapy.—In South America, this plant has some reputation for its influence upon genito-urinary disorders, gonorrhœa, gleet, cystitis, and catarrhal inflammations of the kidneys. It has also been used for rheumatism, and as a tonic in dyspepsia and general debility. In cirrhosis it is especially recommended by Campenon. Boldine, the active principle, has hypnotic powers, and has been successfully tried in France as a substitute for opium or chloral (Juranville). It also has a local anæsthetic action, like cocaine.

BORAX (B. P.).—**Borax.** (See **Acidum Boricum.**)

BROMUM (U. S. P.).—**Bromine.**

Dose, 0.12 to 0.18 c.cm. (or *m*ii-iij), well diluted.

BROMOFORMUM (U. S. P.).—**Bromoform, Tribromomethane** (CH Br3).

Dose, 0.06 to 3.25 c.cm. (*m*j-l).

Preparations.

Calcii Bromidum (U. S. P.).—Calcium Bromide. Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Lithii Bromidum (U. S. P.).—Lithium Bromide. Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Zinci Bromidum (U. S. P.).—Zinc Bromide. Dose, 0.065 to 0.13 Gm. (or gr. i-ij).

Camphora Monobromata (U. S. P.).—Monobromated Camphor. Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Ammonii Bromidum (U. S. P., B. P.).—Ammonium Bromide. Dose, 0.65 to 2.60 Gm. (or gr. x-xl).

Potassii Bromidum (U. S. P., B. P.).—Potassium Bromide. Dose, 0.65 to 4 Gm. (or gr. x-3j).

Sodii Bromidum (U. S. P., B. P.).—Sodium Bromide. Dose, 0.65 to 4 Gm. (or gr. x-3j).

Acidum Hydrobromicum Dilutum (U. S. P., B. P.).—Diluted Hydrobromic Acid (10 per cent.). Dose, 1.20 to 7.5 c.cm. (or *m*xx-f3ij).

Unofficial Preparations.

Æthylis Bromidum.—Bromide of Ethyl, or Hydrobromic Ether. For inhalation as a general anæsthetic.

Auri Bromidum.—Bromide of Gold. Dose, 0.01 to 0.03 Gm. (or gr. $^1/_6$ to $^1/_2$).

Auri et Ammonii Chloridum.—Chloride of Gold and Ammonium. Dose, as above.

Niccoli Bromidum.—Nickel Bromide. Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Syrupus Ferri Bromidi.—Syrup of Ferrous Bromide (10 per cent.). Dose, 0.60 to 4 c.cm. (or *m*x-f3j).

Coniinæ Hydrobromidum.—Coniine Hydrobromide. Dose. 0.004 to 0.005 Gm. (or gr. $^1/_{10}$-$^1/_{12}$).

Pharmacology. — Bromine, which obtains its name from its offensive odor, is a brownish-red, non-metallic liquid element, obtained from sea-water; combining readily with alcohol, ether, or chloroform; and soluble in 33 parts of water at 59° F. When added to water, ozone is liberated. It completely volatilizes upon exposure to the air, giving off a highly-irritating, suffocating odor like that of chlorine, with which it may be contaminated. The pharmacopœial tests require the chlorine to be not more than 3 per cent., and that there shall be only traces of iodine.

Physiological Action.—It is unfortunate that the smell of bromine is so obnoxious, since it is a true disinfectant, rivaling mercuric chloride, and, it is claimed, has even more influence than that agent in preventing the development of spores. A 2-per-cent. solution in water destroys the spores of anthrax. Applied to the skin, it is a penetrating caustic in its pure state, and, diluted, is astringent and antiseptic. Internally, its effects resemble those of iodine and chlorine, causing paralysis of the brain-centres, death resulting from paralysis of respiration.

In cases of poisoning by swallowing this agent, the stomach must be thoroughly irrigated, and a purgative like croton-oil administered in alkaline solution (Vichy water). When inhaled, warm vapor from the steam-atomizer with alkaline solution (Dobell's solution) would afford relief to the irritation. The bromides taken upon an empty stomach in concentrated form sometimes cause gastralgia, which may be relieved by hot water and an hypodermic injection of morphine, combined with atropine, if stupor be present. After death the bromides are found in the brain, principally (Doyon).

In medicinal doses the bromides and hydrobromic acid exert a sedative effect upon the functions of the brain, produce insensibility of the mucous membrane of the fauces, and allay irritability of sensory nerves, as is very well shown by their effect in the treatment of tinnitus aurium after administration of quinine. It has a special action upon the genito-urinary tract, obtunding sensibility and preventing erections or ovarian excitement. On the other hand, sodium bromide has, in a few instances, been known to produce nocturnal erections and seminal emissions from relaxation. The bromides act directly upon the spinal cord, reducing reflex action and, when continued, diminishing motor power and producing paralysis of the legs. The circulation is also affected by their action upon the cardiac ganglia. In the case of potassium bromide, we have superadded the toxic action of potash upon the heart-muscle, by reason of which, when given in large doses, the

arterial tension is reduced and the pulse-rate lowered. In the usual doses, however, this effect is hardly observable.

According to the studies of Germain Sée, potassium bromide causes dilatation of the heart. The right side of the organ appears to be more decidedly affected. It was said (by Hammond) to reduce the cerebral circulation, causing anæmia by contraction of the arterioles. It is probable that the hypnotic effect of bromides is due more directly to their action upon the brain-centres, especially the motor and intellectual portion of the cortex cerebri. To its faculty of reducing reflex nervous excitability is to be ascribed its well-known antispasmodic effects in convulsive disorders. No marked effect upon temperature or respiration has been observed from medicinal doses; very large doses may reduce both, and also diminish tissue-waste.

The rate and the force of the heart's action are likewise diminished and arterial pressure reduced by excessive doses. When continually administered in moderately-large doses, the bromides sometimes excite nausea and diarrhœa. A sedative action is exerted by the bromides upon the sympathetic nervous system.

The bromides have considerable diffusive power, and are found in most of the secretions and in the interior of glands like the liver; after long administration they accumulate particularly in this organ, and the amount of bromide retained in the liver is very great. It has been surmised that this saturation of the system by bromide predisposes to tuberculosis. M. Féré states that, although he has seen nothing in patients to corroborate the supposition, guinea-pigs saturated with potassium bromide and inoculated with tuberculosis succumb more rapidly than animals to whom the salt had not been given. It has likewise been shown that the bromides accumulate in the brain and other organs. The glandular elements of the skin are stimulated and an acneiform eruption follows their prolonged use.

The use of the bromides is occasionally followed by the development of erythema or a brownish discoloration of the skin. In other instances it has caused an eruption similar to that of eczema, wheals, or ulcers. The effect upon the skin may be produced within a day or two after administration of the drug, but usually occurs only after saturation of the system. An eruption occasionally appears upon the body of a nursing infant, when the mother is upon a course of bromide treatment. The bromides are eliminated from the system by the secretions generally, but more particularly by the glands of the fauces, skin, bronchi, and bowels, and by the kidneys. Absorption is much more rapid than elimination.

Therapy.—For its caustic effect, bromine has been used in alcohol (1 to 2 or 3) in hospital gangrene, and in gynæcology as an application to cancer of the uterus. Diluted with sweet oil (0.60 c.cm. to 30 c.cm., or *mx* to f℥j), it is a sedative dressing for rhus-poisoning or chancroids. Bromine is employed, like carbolic acid, as a disinfectant for drains, but is too offensive for use in this way in the sick-room. The bromides are not often used as topical remedies, though an aqueous solution of the strength of 0.65 to 1.30 to 30 c.cm. (or gr. x-xx to f℥j) may be serviceable in paræsthesia. Finely-powdered potassium bromide is stimulant to chronic ulcers, and has been advantageous in epithelioma. It has been applied, added to 5 parts of glycerin, to hæmorrhoids and fissure of the anus, in order to relieve pain. In treating laryngeal diphtheria, or membranous croup, the following may be used:—

℞ Bromi		30 c.cm. or *mv*.
Potassii bromidi	4	Gm. or 3j.
Syrupi simplicis	28	c.cm. or f3viiss.
Decoti althææ	q. s. ad 120	c.cm. or f3iv.—M.

For a child of one year, the bromine should be reduced to one-third, and from one to four years two-thirds, of the quantity in this formula, of which 30 c.cm. (or f3j) are to be given every hour, while the symptoms are urgent (Redenbacher). The official solution of hydrobromic acid has not answered the expectation of those who urged its use as a substitute for the bromides; it may be less liable to produce acne, but it is irritating and less efficient. It may be given for the relief of tinnitus aurium, headache, or to prevent unpleasant symptoms from the effects of quinine:—

℞ Quininæ hydrobromidi	1	55 Gm. or gr. xxiv.
Acid. hydrobromic. dilut.	15	c.cm. or f3ss.
Elixir aurantii	105	c.cm. or f3iiiss.

M. Sig.: Dose, a tablespoonful after meals.

Special Applications.—The special use of the bromides is found in the treatment of convulsive disorders, such as spasm of the larynx or epilepsy. In the former affection a few doses of 0.65 Gm. (or gr. x) or more in a child, are usually sufficient to accomplish a cure; but in the latter the treatment often extends over months and years. When the bromides are continued for a long time, **bromism** is apt to be produced, the physiological action of bromine being shown by eruptions upon the skin, especially of the face; loss of reflexes; dragging, heavy sensations; and difficulty in locomotion, and in some cases special tendency to convulsive attacks appear. It therefore becomes necessary to intermit the bromide or change from one to another, and, if there is too much depression of the vital powers, digitalis may be prescribed in combination, or strychnine given hypodermically in minute doses (0.0005 to 0.001 Gm., or gr. $^1/_{120}$-$^1/_{60}$) several times daily. Brown-Séquard preferred a combination like the following, in treating epilepsy, for a child ten years of age:—

℞ Potassii iodidi	4	Gm. or 3j.
Potassii bromidi	31	Gm. or 3j.
Ammonii bromidi	10	Gm. or 3iiss.
Potassii bicarbonatis	2	60 Gm. or gr. xl.
Spiritus chloroformi	7	50 c.cm. or f3ij.
Infusi calumbæ	q. s. ad 180	c.cm. or f3vj.

M. Dose, 7.5 c.cm. (or f3ij) morning and noon and 11 c.cm. (or f3iij) at night, diminishing the quantity after the convulsions cease, but continuing the remedy at intervals, especially at the time when the fits are liable to recur. If the patient be weak, the infusion of digitalis may be substituted for the calumba.

M. Ch. Féré states that most of the ill effects of the bromide may be avoided by the simultaneous administration of an intestinal antiseptic. In the management of epilepsy he has often made use of the following combination:—

℞ Potassii bromid.	6	Gm. or 3iss.
Naphthol	4	Gm. or 3j.
Sodii salicylat.	2	Gm. or 3ss.

M. Sig.: To be divided into three doses. One dose to be taken three times a day.

In treating epilepsy, the partial insensibility of the fauces is the guide to the administration of bromides; this should be established as soon as possible and maintained during the continuance of the treatment, which should not be pushed to the point of bromism. Small doses of arsenic will prevent, to some degree, the eruption in persons especially susceptible to bromides, and it is well to alternate the iodides with the bromides in order to prevent undue accumulation of the latter in the system. The beneficial action of the bromides is particularly marked when epilepsy is due to disorder of the sexual apparatus. On the other hand, the *petit mal* is much less amenable to their influence than the general convulsive seizures. Potassium bromide has a certain sphere of usefulness in whooping-cough. It is of no avail when the bronchitis is severe, or when pneumonia is present; but in simple uncomplicated pertussis, above all when convulsions or a tendency to convulsions exist, this remedy is of great service in allaying the congestion of the nervous centres. Spasmodic asthma is, in some instances, considerably benefited by the exhibition of bromide, and its efficacy is enhanced by combination with the iodide. The bromides are of decided value in infantile convulsions, especially when these depend upon reflex irritation. They are likewise of service in the convulsions symptomatic of simple meningitis, and not altogether without avail in alleviating those of tubercular meningitis. Uræmic convulsions may sometimes be successfully treated by potassium bromide in combination with chloral-hydrate, assisted by active purgation and diaphoresis. When cholera infantum is associated with excessive nervous irritability, potassium bromide serves a useful purpose, as it does also in those cases in which flatulent colic of infants is connected with marked intestinal spasm. Dr. Harvey Vanatta, of Seal, Ohio, administered potassium bromide with success in a case of invagination of the bowel.

In treating nervous irritability, restlessness, and insomnia it is well to combine bromides with other hypnotic agents:—

℞ Potassii bromidi	1 |	vel	1 |30 Gm.	or gr. xv vel xx.
Chlorali hydrati			|65 Gm.	or gr. x.
Aquæ camphoræ,				
Syr. lactucarii	aa	4 |	c.cm.	or f℥j.

M. Sig.: Pro dosi. For nervous headache with insomnia.

The sedative and antispasmodic effects are increased by combination with gelsemium, asafetida, or valerian, and smaller doses are required than when each agent is administered alone. In Ménière's disease, Ferreri reports good results from the use of large doses of potassium bromide in conjunction with ferric valerianate. In the affections of the genito-urinary organs the bromides are of especial value when spasm or pain is present. The quantity of urine is increased and also the proportion of urea. The sexual functions are depressed; and the bromides are largely used as **anaphrodisiacs** in priapism and nymphomania, especially when given in conjunction with tartar emetic in minute doses.

A good formula used by the author for gonorrhœa with chordee is the following:—

℞ Potassii bicarb.	12 |	Gm.	or ℥iij.
Potassii bromidi	15 |5	Gm.	or ℥iv.
Tincturæ hyoscyami	30 |	c.cm.	or f℥j.
Spiritus chloroformi	15 |	c.cm.	or f℥iv.
Inf. buchu q. s. ad	240 |	c.cm.	or f℥viij.

M. Sig.: A tablespoonful in barley-water every three or four hours. This combination relieves scalding and chordee.

The following are also valuable prescriptions containing the bromides:—

℞ Sodii bromidi ..... 27| Gm. or 3vij.
Antimonii et potassii tart. ..... |03 Gm. or gr. ss.
Aquæ camphoræ,
Spiritus ætheris nitrosi ..... aa 45| c.cm. or f℥iss.
Syrupi aurantii ..... 60| c.cm. or f℥ij.
M. Sig.: Two teaspoonfuls in water every two or three hours until relieved. Serviceable in epididymitis, cystitis, and prostatitis.

℞ Ammonii bromidi,
Salol. ..... aa 4| Gm. or 3j.
M. et ft. capsulæ no. xij.
Sig.: Two capsules every hour or two. Employ in gonorrhœa and all irritable conditions of the genito-urinary organs.

The menses are delayed and rendered less in quantity, by the use of the bromides. When menorrhagia is caused by ovarian congestion, potassium bromide restrains the flow, and the same agent sometimes proves of service in metrorrhagia. In the profuse and irregular menstrual discharges, which often occur as the menopause is neared, the same remedy is of value. The headaches, flushing of the face, subjective sensations of heat, and other anomalous symptoms which characterize the same period receive notable relief from the bromides. Chordee occasionally yields to the same agent. In spermatorrhœa and atonic impotence, dependent upon irritation or subacute chronic inflammation of the deep urethra, the bromide is valuable by diminishing the reflex irritability of the genital centre in the cord. But, in diurnal pollution due to debility of the genital centre, this remedy is harmful and should be avoided. In all cases of reflex nervous disorders having origin in ovarian irritation the bromides have a well-established reputation, but should not be given freely in anæmic subjects. In reflex cough—or so-called uterine cough, stomach-cough, ear-cough, etc.—we may give:—

℞ Potassii bromidi ..... |32 to |65 Gm. or gr. v vel x.
Syr. pruni Virg. ..... 7|5 c.cm. or f3ij.
M. Take every four to six hours. The above is also useful in the cough of children, in smaller doses.

When it is desired, in laryngology, to make an examination or an operation upon a very sensitive throat, the use, for a few days, of full doses of potassium bromide will greatly assist in reducing such hyperæsthesia. In various hysterical throat affections, the bromides are of the greatest value.

In irritability of the bladder in women who use sewing-machines, or others, the following is serviceable:—

℞ Potassii vel sodii bromidi ..... 1|30 Gm. or gr. xx.
Infus. uvæ ursi ..... 4| c.cm. or f3j.
M. Sig.: Take every hour or two until relieved.

In migraine, the combination with opium is valuable:—

℞ Tr. opii deodorat. ..... 4| c.cm. or f3j.
Potassii bromid. ..... 8| Gm. or 3ij.
Acid. hydrobromic. dil. ..... 60| c.cm. or f℥ij.
Syr. aurantii .....q. s. ad 120| c.cm. or f℥iv.
M. Sig.: Take a dessertspoonful in water, every two or three hours.

Cases of maniacal excitement, puerperal, alcoholic, or other, are relieved by full doses of bromides, especially when combined with chloral.

Many acute attacks of fever in children, with delirium, are promptly cured by bromides, in small doses given every few minutes. Seasickness and the vomiting of pregnancy are controlled by small doses of bromides in effervescent salt; large doses have occasioned temporary derangement of mind, and have brought this remedy into disrepute because improperly used. In poisoning by strychnine and in tetanus, large doses of the bromides have proved successful in subduing the convulsions.

In acute cerebral congestion potassium bromide is of great value through its influence upon the vasomotor system. It is very serviceably given in conjunction with the fluid extract of ergot, which aids its action by constringing the cerebral vessels. The headache and wakefulness are also relieved by the bromide. The same drug is efficacious in allaying cerebral vomiting. Insomnia, caused by nervous strain or excessive mental application, is successfully treated by means of the bromide. The headache of pachymeningitis is generally best controlled by a combination of potassium bromide and iodide, as:—

℞ Potassii iodidi ..... 10| Gm. or ʒiiss.
Potassii bromidi ..... 19|5 Gm. or ʒv.
Syrupi aurantii,
Syrupi simplicis ..... aa 60| c.cm. or fʒij.
M. Sig.: Dose, two teaspoonfuls three or four times daily.

In exophthalmic goitre, the excessive cardiac action may often be restrained by the bromide. This remedy may be useful in subacute and acute rheumatism, especially when the acute form of the disease is accompanied by considerable fever and delirium. The restlessness and delirium of the third week of typhoid fever are often admirably controlled by a bromide. The same agent is very efficacious in preventing the night-terrors of children. It is claimed that potassium bromide is useful in diabetes mellitus of nervous origin. The salt relaxes nervous spasm of the œsophagus and allays the nervous symptoms of rachitis. Potassium bromide and iodide are recommended in eliminating metals—as mercury, copper, or lead—from the system. The bromide may be useful in reducing enlarged lymphatic glands and spleen, though far inferior to the iodide. A bromide addition to a prescription increases the effect of hypnotic or narcotic medicines, and it is often able to obviate the unpleasant consequences of opium.

Victor Augagneur has found potassium bromide of service in certain syphilitic manifestations. Dysphonia or aphonia sometimes occurs, especially in women, in the sixth or seventh month of the disease. In the belief that it depends more upon disturbed innervation than upon the erythema of the laryngeal mucosa, he is accustomed to give bromide in combination with potassium iodide with very good results. In serious tertiary disease of the larynx the iodide may give rise to dyspnœa. In this condition it is advantageous to practice mercurial inunction and depend upon the bromide to reduce reflex excitability. When the dyspnœa has been allayed, the bromide and iodide may be administered in association. The addition of the bromide to the iodide is also of value in cerebral syphilis.

According to Dr. Wilks, the bromides often have a good effect in causing reduction of goitre. They have also been used with success in order to diminish the volume of fibroid tumors of the womb.

During administration of the bromides the digestive functions may become disordered, and it is necessary to occasionally give cholagogal cathartics to keep the liver up to its work.

In comparing the bromides we observe some difference in their effect and therapeutic applications.

Potassium bromide is the most frequently prescribed, and is the most efficient. Where the circulation is weak, the other salts, especially the ammonium salt, are to be preferred.

Sodium bromide is the least toxic, and is preferred in cases where nutrition is poor, especially in anæmic women and children. It is not so efficient in cases of a uric-acid diathesis or lithæmia, as other salts, and notably that of lithia.

Lithium bromide has been thought to possess more hypnotic power than the potassium bromide. Ammonium bromide combines the stimulating action of the ammonia with the hypnotic effect of bromine, and is useful in cerebral rheumatism. The manifestations of bromism are not so readily excited by the ammonium salt as by that of potassium or sodium. Ammonium bromide is useful in whooping-cough.

Nickel bromide, introduced by Da Costa for the treatment of epilepsy, has the advantage of the smallness of the dose, but the disadvantage of the metallic poisoning when too long continued. It is best given in effervescent salt or in the form of a syrup mixed with orange-flower water. The salt is green in color, deliquescent, and soluble in water. It is well borne by the stomach, relieves congestive headaches and convulsive movements. Zinc bromide is little used; it is supposed to combine the well-known action of zinc upon the central nervous system with the bromide action. The syrup of ferrous bromide has been employed for chorea in anæmic children, with good results.

Strontium bromide appears to have decided advantages over the other bromides in the treatment of epilepsy. Dr. Antony Roche has published[1] notes of successful cases and says that he has not met any case in which the bromide of strontium, given in the prescribed doses and according to his method, has failed to diminish the number of the attacks. In many instances there had been no return for periods extending to two, three, or even four years. He usually begins the treatment of epilepsy by ordering 2 Gm. (or ℥ss) of the strontium salt, night and morning in some vegetable tonic infusion. Should this dose not control the attacks, he rapidly increases it until he finds the quantity that will suit the individual case. In cases where there is distinct warning before the attacks he gives 2 Gm. (or ℥ss) at once, and directs this dose to be repeated every hour, if required. In this way he has succeeded in preventing an attack. In order to get the full benefit of the treatment he has found it necessary to give this remedy in large doses and to continue it for a long period. Dixon Mann in his "Manual of Medical Jurisprudence" says, with regard to the safety of this treatment, that strontium salts cannot be regarded as poisonous. He had himself taken 12 Gm. (or ℥iij) daily for weeks without any unpleasant symptoms. The strontium bromide does not cause the depression that follows the potassium salt.

Bromamid.—Fischedick and Koechling have introduced a compound

[1] *Lancet*, Oct. 15, 1898, p. 987.

of the aniline group containing 75 per cent. of bromine and designated by them as bromamid. It is obtained in the form of colorless, odorless, and tasteless needle-shaped crystals, insoluble in water, but soluble in boiling alcohol, ether, chloroform, and the fixed oils. It melts at 243° F. and volatilizes at 310° F. without change. No symptoms are produced in dogs by doses of 2 Gm. (or gr. xxx). The pulse-rate is, in adults, retarded by a dose of 0.65 Gm. (or gr. x). Bromamid reduces a febrile temperature 1° to 2.5° F. without excessive sweating. It does not disorder digestion or produce diuresis. This substance has been employed as an antipyretic and antineuralgic in doses of 0.65 to 1 Gm. (or gr. x-xv) several times a day to adults and 0.065 to 0.32 Gm. (or gr. i-v) to children. Bromamid may be administered in capsules and wafers or suspended in a fluid.

Bromipin is a solution of bromine in sesame-oil (10 per cent.). It has been used internally in the treatment of epilepsy by Zimmermann, of Hanover. The dose is 4 to 15 c.cm. (or f3i-iv) three or four times daily; with epileptics the dose may be increased to double this quantity. (One tablespoonful of bromipin represents about 1.49 Gm., or gr. xxiij, of combined bromide, equivalent to 2.20 Gm., or gr. xxxiv, of potassium bromide.)

Bromoform.—Tribromomethane. If to methane, or marsh-gas (CH_4), be added 3 atoms of bromine in substitution for 3 of hydrogen, we get methyl bromide, or bromoform ($CHBr_3$), analogous, therefore, in composition to chloroform or iodoform. Bromoform is an oily liquid, having an agreeable odor resembling that chloroform. It has a sweet taste, does not affect the mucous membrane of the mouth, and has no irritant effect. It is rapidly decomposed by light. Its density is 2.77, and it boils at 150° C. Insoluble in water, it dissolves in alcohol and ether, its reactions being similar to chloroform. It usually is present in small proportion in commercial bromine, and is made by adding bromine to a solution of an alkaline hydrate in alcohol or wood-spirit. A fluid ounce of bromoform contains 360 drops.

Bromoform was first introduced by Stepp, of Nuremberg, in 1889, as a valuable remedy in whooping-cough. In children aged from six months to one year, 0.12 c.cm. (or *m*ij) may be given three or four times daily, and the dose is increased by about a drop for every additional year of age. The dose for adults is 0.545 to 0.80 c.cm. (or *m*vii-xiij) in capsules. Bromoform diminishes the frequency, severity, and duration of the paroxysms of pertussis, has a favorable influence upon the mucous secretion, and generally abolishes vomiting and the hæmorrhages within a short period. The most severe cases are perceptibly benefited within eight days. Dr. S. Solis-Cohen has used bromoform with beneficial results, as a local application, in the treatment of tubercular and other ulcers of the throat. He recommends its combination with iodoform. The local application of bromoform is also of utility in ozæna.

Dr. Ponticaccia reports that bromoform, given in daily doses, progressively increasing from 1 to 3.25 c.cm. (or *m*xv-l), has an excellent sedative effect in cases of acute mania. He found the same remedy of value in delirium tremens, in which it allayed restlessness and induced sleep. Several fatal cases of poisoning from bromoform have been reported, the patient in each case being a child who had taken a large quantity (30 to 40 minims).

When bromoform is given suspended in a gummy mixture, accidents have happened through neglecting to thoroughly shake the bottle, before

pouring out the medicine. It is insoluble in dilute alcohol, but may be dissolved by the aid of glycerin, and a formula has been proposed by the late P. W. Bedford which forms a perfect and palatable solution (each fluidrachm contains 0.06 c.cm., or *mj*, of bromoform):—

℞ Bromoform		1|	c.cm. or *m*xvj.
Alcohol,			
Tr. cardam. co.	aa	7|5	c.cm. or f℥ij.
Glycerini		45|	c.cm. or f℥iss.—M.

Bromogallic Acid.—This substance, otherwise known as **bromogallol,** resembles bromic acid, in which two atoms of hydrogen have been replaced by bromine. The blood of a dog poisoned by bromogallol was of a saffron color and contained a large quantity of methæmoglobin. Respiration was at first accelerated, but afterward retarded. Lépine and Cazeneuve, of Lyons, have employed it as a *succedaneum* of potassium bromide. It appeared to be useful in chorea, but less efficient in epilepsy than the salt of potassium. This preparation, known also as gallobromol, has been used with success locally in eczema rubrum and other stubborn forms of eczema in the form of a 1- to 2-per-cent. solution, powder, or ointment. In cystitis and epididymitis 2- to 4-per-cent. solutions have been employed by irrigation.

Bromol, or **Tribromphenol,** is obtained by the action of bromine in excess on carbolic acid. It possesses antiseptic properties, and has been used with advantage in the local treatment of wounds, ulcers, and diphtheria. In the last-named affection Rademaker recommends a mixture of 1 part of bromol with 25 parts of glycerin. Bromol has been given internally in cholera infantum in doses from 0.005 to 0.015 Gm. (or gr. $^1/_{12}$-$^1/_4$). On the ground of his experimental and clinical investigations, Dr. Tschourilow states that tribromphenol is an excellent application in erysipelas. He made use of it in the form of a 1-, 2-, or 3-per-cent. ointment.

BRYONIA.—Bryonia (Bryony).

Preparations.

Tinctura Bryoniæ.—Tincture of Bryonia (10 per cent.). Dose, 4 to 15 c.cm. (or f℥i-iv).

Extractum Bryoniæ Fluidum.—Fluid Extract of Bryonia. Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Bryonin.—The active principle. Dose, 0.01 to 0.02 Gm. (or gr. $^1/_6$-$^1/_3$).

Pharmacology.—Bryonia alba and Bryonia dioica (Cucurbitaceæ) are the official sources of the root known as bryonia, which must be recently dried, as an old drug is useless. It contains two glucosides, **Bryonin** and **Bryonidin**; the former is a poison, and is the principal constituent; it appears in pearly crystals or in white powder; it is very bitter; soluble in water and alcohol. On being boiled with diluted sulphuric acid, bryonin splits up into glucose and a resin, **Bryogenin.** A second resinous principle, **Bryoresin,** is also found in the root.

Physiological Action.—The juice of the fresh plant blisters the skin. The drug, taken taken internally, acts as an irritant, and is a hydragogue cathartic. It also increases the flow of urine. Bryonia acts as an irritant upon serous membranes, and in toxic doses causes gastro-intestinal inflammation, with nausea and vomiting, and gives rise to symptoms of meningitis. Death has followed in several cases. Its antidotes are opium and stimulants.

Therapy.—As there are better purgatives, bryonia is not required for this purpose. It is reported to have been used with success in atonic dyspepsia. It is used, in small doses, in rheumatism, pleurisy, and other serous inflammations, after the fever has abated. It appears to be especially serviceable in the muscular pains and stiffness following colds. In chronic bronchitis it has been advocated. Bryonia has been recommended in the catarrhal stage of whooping-cough and in cases of enlarged spleen from chronic malaria, and, also, by Petresco, in cases of hæmorrhage, especially in epistaxis. In chronic or subacute pharyngitis, the tincture has been employed, with asserted good results.

BUCHU (U. S. P.).—**Buchu.**

BUCHU FOLIA (B. P.).—**Buchu-leaves.**

Preparations.

Fluidextractum Buchu (U. S. P.).—Fluid Extract of Buchu. Dose, 0.60 to 4 c.cm. (or *m*x-f3j).

Infusum Buchu (B. P.).—Infusion of Buchu (one to sixteen). Dose, 4 to 8 c. cm. (or f3i-ij).

Tinctura Buchu (B. P.).—Tincture of Buchu (20 per cent.). Dose, 2 to 4 c.cm. (or f3ss-j).

Pharmacology.—The dried leaves of Barosma betulina (Rutaceæ), derived from good-sized, erect, and widely-branching shrubs of southern Africa. They contain an **oleoresin,** which is the most active constituent. They also contain a bitter glucoside, **Barosmin.** The oil of Buchu contains 30 per cent. of the characteristic, crystallizable phenol known as diosphenol ($C_{10}H_{16}O_2$). The fluid extract does not mix readily with water, on account of the presence of the oil and extractives.

Physiological Action.—Buchu-leaves have a strong, mint-like odor and a bitter, pungent taste. When taken into the stomach, a warming, carminative effect is produced by small doses, but very large ones cause irritation. The volatile oil diffuses into the blood, slightly stimulating the circulation, increasing the quantity of the urine, and imparting to it a peculiar, aromatic odor. In process of excretion the remedy acts as an astringent and disinfectant upon the urinary organs, especially the bladder. As a portion is eliminated by the bronchial mucous membrane, a stimulating influence is also exerted here in relaxed conditions accompanied by increased secretions. When used to excess or for a long period, or in too large quantity, the kidneys suffer and degenerate or inflammatory conditions are initiated.

Therapy.—The principal use of this agent is for disorders of catarrhal character affecting mucous membranes and diseases of the genito-urinary organs. In incontinence of urine, or want of tone in the bladder, good results usually promptly follow its administration. Buchu affords relief in irritability of the bladder, in subacute or chronic cystitis, and in pyelitis. Through the enterprise of the owners of proprietary remedies, buchu has a popular reputation for the cure of gonorrhœa, but, owing to the quantity of alcohol contained in the fluid extract, this should not be used during the existence of acute inflammation, and only with great care in chronic urethritis, or gleet. The recent infusion is perhaps the best preparation. It may be combined with uva ursa (3iv of each to a pint of boiling water).

There are many good reasons for believing that the much-advertised "buchu-cures" for gonorrhœa contain no buchu-leaves whatever, but are made from the leaves of uva ursi and other domestic plants. Buchu resembles oil of turpentine very much in its physiological effects, and is useful in much the same class of cases. In gleet it appears to be highly serviceable. Buchu has been used with success in chronic bronchitis, atonic dyspepsia, lithæmia; and in chronic rheumatism it may be administered sometimes with advantage. Not having very decided diuretic properties, it is of little value in dropsy.

BURSA PASTORIS.—Shepherd's purse is a small plant belonging to the Cruciferæ, a native of Europe, but growing luxuriantly in this country in cultivated lands during the months of April and May. The plant has a bitter, astringent, and strongly-pungent taste. It contains a volatile oil, resembling oil of mustard, a glucoside, bitter principle, resin, etc.

According to von Oefele, the virtues of the plant depend upon the presence of **bursinic acid**, the salts of which, with iron and sodium, may be given in 0.10 Gm. (or gr. iss) doses several times a day. Of the tincture, made with fresh leaves, the dose is 0.60 to 4 or 15 c.cm. (or *m*x-f℥i-iv), given in cases of hæmorrhage from the lungs, kidneys, or uterus, and also in diarrhœa and dysentery. A fluid extract is also made, the dose of which is from 2 to 4 c.cm. (or f℥ss-j). Both preparations are miscible with water without precipitation.

BUTYL-CHLORAL HYDRAS (B. P.). — **Butyl-chloral Hydrate.** (See **Chloral Hydrate.**)

CACTUS. — Cactus. Night-blooming Cereus, the Cereus grandifloris (Cactaceæ), is a plant of Mexico, with large, showy, nocturnal-blooming flowers, of pearl-white petals, which have a heavy perfume. A tincture of the fresh stems and flowers (124 Gm. to 473 c.cm., or ℥iv-Oj alcohol) is claimed by Rubini to be a valuable cardiac tonic in doses of 0.06 to 0.30 c.cm. (or *mi*-v) three times a day. Probably these doses might be much increased, as Kunge gave 1.20 c.cm. (or *m*xx) at once, and H. C. Wood was unable to perceive any effect from them at all. A difference might be accounted for on the ground that some use the fresh plant and others the flowers and leaves recently dried, the latter being the stronger preparation. The constituents of Cactus are unknown. It contains several acid, glucosidal, resinous bodies, and also an alkaloid, which is present in very small quantity. Boinet and Boy-Teissier determined that, in frogs, cactus increases cardiac energy, but that the effect is transitory. Dr. Reynold W. Wilcox states that the physiological action of cactus is upon the intracardiac ganglia and accelerator nerves, through the cardiac plexus of the sympathetic system, and that there is no interference with the inhibitory nerves, nor does its administration produce any very marked vasomotor changes. It shortens the ventricular systole and increases the blood-pressure. Sultan has extracted an active principle, which he terms **Cactin**, from the young flowers of the plant. He states that cactin increases the energy of the cardiac contractions, heightens arterial tension, and has a direct action upon the motor centres of the spinal cord. It produces reflexes, increases the general nervous tone, and can be used for a long period without causing gastric symptoms or cumulative effects. Both pulse and blood-pressure are reduced by toxic amounts.

The action of the heart is rendered irregular and it is arrested in systole. Death is preceded by clonic and tetanic convulsions, caused by overstimulation of the motor tract of the cord. Dr. Wilcox found it especially useful in uncompensated cases of valvular disease, in relative incompetency due to muscular degeneration, in weak hearts after typhoid fever, in functional heart diseases from alcohol, dyspepsia, sexual exhaustion, etc., and in the palpitation of exophthalmic goitre. In aortic regurgitation, he considers it to be the drug *par excellence,* while in mitral stenosis it should be avoided. Watson Williams has found cactus beneficial in mild cases of angina pectoris. Cactus has also proved itself efficient in cardiac dropsy.

CADMIUM.—**Cadmium** is found combined with zinc, in native ores. It resembles tin in general appearance, and its salts are white and permanent; they are soluble in water. They are astringent and resemble the corresponding zinc salts, producing emesis, but they are principally employed for their local effects. Small doses of the salts of cadmium excite (whether given by the mouth or hypodermic injection) inflammation of the gastro-intestinal mucous membrane, and ulceration may occur. In addition they may cause giddiness, loss of consciousness, and retardation of circulation and of respiration. Alkaline carbonates and white of egg are the proper antidotes. The ointment of the iodide (1 to 8 of lard) or the oleate may be used in chronic enlargement of glands or joints, and especially in goitre. It has also been recommended as an application in cases of enlarged spleen. It is said not to discolor the skin. Lincke has made use of injections of cadmium sulphate in leucorrhœa and gonorrhœa. The sulphate may be employed as an astringent wash (in solutions, $^1/_2$ per cent.) or as an ointment (1 to 40 benzoinated lard). In solution the sulphate is used as a collyrium.

CAFFEINA (U. S. P., B. P.).—**Caffeine, Theine** ($C_8H_{10}N_4O_2 + H_2O$). **Dose,** 0.13 to 0.65 Gm. (or gr. ii-x). B. P., 0.065 to 0.32 Gm. (or gr. i-v).

Preparations.

Caffeina Citrata (U. S. P.).—Citrated Caffeine. Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Caffeina Citrata Effervescens (U. S. P.).—Effervescent Citrated Caffeine. Dose, 4 to 12 Gm. (or 3i-iij).

Caffeinæ Citras (B. P.).—Caffeine Citrate. Dose, 0.13 to 0.65 Gm. (or gr. ii-x).

Caffeinæ Citras Effervescens (B. P.).—Effervescent Caffeine Citrate. Dose, 4 to 8 Gm. (or 3i-ij).

Pharmacology.—Caffeine is a feebly-basic proximate principle obtained from the dried leaves of Thea sinensis (Ternstromiaceæ), or from the dried seeds of Coffea arabica (Rubiaceæ), and found also in other plants, or prepared synthetically (U. S. P.). An alkaloid usually obtained from the dried leaves of Camellia Thea, or the seeds of Coffea arabica (B. P.). Paraguay tea, or mate, the Brazilian holly (Ilex Paraguensis), also contains caffeine, and is largely used as a hot beverage and stimulant in South America. It exists also in the kola-nut of Africa, the fruit of Sterculia acuminata (Sterculiaceæ). It is closely related to theobromine, existing in theobroma cacao, and to cocaine, found in erythroxylon coca, both in chemical composition and effects upon the human body. Caffeine has been synthetically made from guanine; and also by heating, in closed tubes, theobromine silver with methyl-iodide.

Citrated caffeine is most frequently employed in medicine on account

of its greater solubility, but Tanret has recently shown that by the addition of an equal weight of sodium salicylate, or benzoate, the solubility of caffeine is greatly increased. Antipyrine has also been found to have the same action; so that by this means the hypodermic administration is greatly facilitated. One and a half Gm. (or gr. xxiv) of antipyrine will enable 1 Gm. (or gr. xv) of caffeine to dissolve in 30 c.cm. (or f℥j) of distilled water, with the aid of heat, forming a permanently-limpid solution.

Caffeine is in the form of colorless, silky, inodorous crystals, sparingly soluble in alcohol and cold water (75 parts), but much more soluble in boiling water (9.5 parts). It is precipitated from its aqueous solution by tannic acid, or solution of potassium iodide and mercury; with the latter reagent the deposit is crystalline, whereas, with other alkaloids, the product is always amorphous when this test is employed. Caffeine was first extracted from coffee in 1821, by Pelletier and Caventou, and by Robiquet and Runge. According to Wurtz, it chemically is methyl-theobromine (or trimethyl-xanthine). The caffeine of commerce is usually derived from damaged tea.

Physiological Action.—It has been claimed by Dr. Mays, of Philadelphia, that the physiological effects of the caffeine obtained from coffee differ from those following the administration of the alkaloid from tea. Mays claims that theine possesses analgesic properties which are absent in caffeine; and that the latter will not affect the heart, while the former causes palpitation. Theine, he has asserted, when injected hypodermically, produces local anæsthesia, whereas pure caffeine will not affect sensibility. Tanret and Fauvel, on the contrary, regard caffeine as an efficient local anæsthetic. It has been held that the well-known differences in the physiological effects of tea and coffee were due to other constituents, and especially to volatile oils, and in the ordinary method of manufacture these might still contaminate the caffeine. It has been shown that tea contains another base, theophylline, isomeric, but not identical, with theobromine and paraxanthine. The presence of this base might also affect the physiological results. The experiments of Dunstan and Shepheard demonstrate that caffeine and theine are identical in chemical properties. Investigations with caffeine prove it to have very decided physiological powers. There is, after its administration, at first increase, but later diminution, of the activity of the reflex centres of the spinal cord. In frogs convulsions and muscular rigidity are caused; the heart's action is at first accelerated and afterward slowed. Arterial pressure at first rises, but subsequently falls. Caffeine stimulates the vasomotor centre and exerts a direct influence upon the heart. It assists the system to resist hunger and fatigue. It has a decided diuretic action. The excretion of urea is at first increased, afterward diminished. Sobieranski,[1] after a series of experiments in the line of Ludwig's theory of urinary secretion, found that, in animals killed at various intervals after the injection of indigo-carmin, this substance was secreted by the glomeruli alone; it was never found in the basal epithelium of the convoluted tubules, which proves again that this epithelium does not secrete. Further experiments proved that after the administration of diuretics, and while the system is fully under their influence, the injection of indigo-carmin varies in its effects. With caffeine, the cells of the convoluted tubules were no longer stained, only a weak coloration here and there in the secreting epithelium,

[1] *Centralblatt für Physiologie*, April 4, 1900.

which he explains by the assumption that caffeine paralyzes the absorbing power of the convoluted tubules, and to this he ascribes its diuretic action. The diuretic salts—sodium chloride, nitrate, and acetate—produce their effect through the blood's increasing the secreting power of the glomeruli while only slightly affecting the absorbing function of the tubules. Urea and kindred substances stand between these, as they raise the osmotic coefficient of the glomeruli on one hand, while they diminish the absorbing power of the convoluted tubules on the other.

When caffeine is given in ordinary doses the rate of respiration is reduced, blood-pressure lowered; temperature slightly increased, afterward diminished. The cerebral functions are stimulated, and, in many persons, wakefulness results. Delirium, alone or associated with visual hallucinations, is sometimes excited by the administration of caffeine. It counteracts the effects of narcotic remedies, and is valuable in the treatment of opium poisoning, although not a complete antidote. When taken into the stomach, caffeine diffuses readily into the blood, and is eliminated by the kidneys and the liver, principally. Small doses increase the appetite and facilitate digestion; there is some irritation of the digestive tract, increasing peristalsis and in some cases causing venous congestion and hæmorrhoids. From a dose of 0.75 Gm. (or gr. xij) of caffeine, Dr. Pratt experienced restlessness, sleeplessness, mental depression, and tremor. A dessertspoonful of the citrate of caffeine produced nausea, stupor, extreme pallor and debility, soft pulse, slow and sighing respiration; but recovery followed the use of emetics, hot applications, and brandy. Zenetz[1] calls attention to the dangers of caffeine. With doses of 0.20 to 0.32 Gm. (or gr. iii-v), two or three times a day, the blood-pressure rises slowly, but steadily, and the quantity of urine is increased. Between the fourth and sixth days the patient complains of constriction in the chest, dyspnœa, and restless nights, due to increased blood-pressure. Death may result from tetanic contraction of the heart. Caffeine continues to be excreted, from the urine, for at least ten to fifteen days after the last dose is taken; so that it resembles digitalis in producing a cumulative effect. Caffeine should be used with caution in all renal diseases, in arteriosclerosis, and atheroma, and all cardiac diseases secondary to them. Another danger of caffeine consists in the existence of idiosyncrasy or excessive susceptibility. Zenetz reports three cases of, in his opinion, death from caffeine; in each the heart was found to be so strongly contracted that it could be cut with difficulty. One was a young man with croupous pneumonia, who was only taking 0.20 Gm. (or gr. iij) three times a day and who died suddenly on the third day.

Therapy.—In migraine, caffeina citrata may be administered, 0.065 Gm. (or gr. j) every hour, with excellent effect; or a cup of strong tea or coffee given. Where there is co-existing liver, kidney, or stomach disorder, a purgative should begin the treatment. Anæmic headache also may be relieved by the administration of caffeine. The hypodermic injection of this agent is sometimes efficient in neuralgia; or it may be administered as follows:—

℞ Caffeinæ citratæ ..... 1|30 Gm. or gr. xx.
Acetphenetidin
Pulv. aromatic. ..... aa 2| Gm. or 3ss.
M. et ft. chartulæ no. x.
Sig.: A powder every two or three hours. Serviceable in migraine, and in neuralgia about the scalp, face, and in sciatica.

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[1] *Wiener medicinische Wochenschrift*, Dec. 9, 1899.

℞ Caffeinæ citrat. ..... 1 | 30 Gm. or gr. xx.
Acetanilidi ..... 1 | 30 Gm. or gr. xx.
Ext. cannabis Indicæ ..... | 20 Gm. or gr. iij.
M. et ft. capsulæ no. x.
Sig.: A capsule every two or three hours for neuralgia.

℞ Caffeinæ citrat. ..... 2 | Gm. or ʒss.
Ammonii bromidi ..... 12 | Gm. or ʒiij.
Elix. guaranæ ..... 60 | c.cm. or fʒij.
M. Sig.: A teaspoonful every hour or two until relieved of pain of neuralgia.

In despondency and hypochondriasis, caffeine, or a cup of hot coffee infusion, will sometimes serve a good purpose. It may be given in order to dissipate the drowsiness which is often produced by a hearty dinner.

As a cardiac stimulant in valvular diseases, dilated or fatty heart, or in the myocarditis accompanying rheumatism, in low fevers, and in dropsy due to weak heart, caffeine may be given hypodermically (0.065 to 0.13 Gm., or gr. i-ij, every two to four hours), or the sodio-benzoate may be employed as recommended by Huchard. When being administered in these cases, caffeine will sometimes give rise to so much insomnia that its use will have to be abandoned, or, at least, temporarily suspended. Dr. Petrescu, of Bucharest, indeed, claims advantage from largely increasing the usual doses, and states that he has administered with good effect as high as 2 to 4 Gm. (or gr. xxx-lx) daily for several consecutive days. Misrachi recommends the use of the sodio-benzoate in puerperal hæmorrhage, and states that when given hypodermically it acts more rapidly than ergot. In chronic Bright's disease caffeine diminishes albuminuria and dropsy. It may be used in co-operation with hydragogic cathartics in ascites. Uræmic coma may sometimes be lightened by the hypodermic administration of caffeine. The hypodermic injection of caffeine is also of assistance in the treatment of opium poisoning. It may be used during the intervals of administration of digitalis, or, where this drug is too slow, given in the following combinations:—

℞ Caffeinæ citrat. ..... 3 | 25 Gm. or gr. l.
Liquor potassii citratis,
Spiritus ætheris nitrosi,
Infus. digitalis ..... aa 60 | c.cm. or fʒij.
M. Sig.: A half-teaspoonful in water every three or four hours. Employ in valvular insufficiency, attended with dropsy.

In weak, dilated heart, with gouty tendency, and in nephritis, the following are useful:—

℞ Caffeinæ citrat.,
Lithii citratis ..... aa 6 | 50 Gm. or gr. c.
Strychninæ sulphat. ..... | 015 Gm. or gr. 1/4.
Oi. gaultheriæ ..... | 30 c.cm. or ♏v.
M. et ft. capsulæ no. xx.
Sig.: One every four hours.

℞ Caffeinæ citrat. ..... 3 | 25 Gm. or gr. l.
Tinct. strophanthi ..... 4 | 50 Gm. or ♏lxx.
Aquæ camphoræ ..... 90 | c.cm. or fʒiij.
M. Sig.: A teaspoonful three times a day. Use in parenchymatous nephritis attended with dropsy.

In pneumonia, or congestion of the lungs with weak heart, in elderly patients, caffeine is an excellent remedy in moderate doses (0.065 to 0.13 Gm.,

or gr. i-ij, given hypodermically every two to four hours). It is likewise of value in the weakened heart of typhoid fever and pneumonia, after the febrile stage has passed. In the diarrhœa of relaxation, typhoid fever, sporadic cholera, etc., the sodio-benzoate or sodio-salicylate may be used, in combination with nux vomica or strychnine.

Cholera infantum and the diarrhœa of phthisis are not infrequently benefited by caffeine. An asthmatic paroxysm may often be relieved by this remedy. On account of its tendency to produce wakefulness it has, generally in the form of a strong coffee (either given by the stomach or injected into the rectum), long been a valuable adjuvant in the treatment of opium poisoning.

Caffeine Tri-iodide. — This compound, a dark-green crystalline substance, readily soluble in alcohol, is a stimulant and diuretic, which has been used in cardiac dropsy in the dose of 0.13 to 0.25 Gm. (or gr. ii-iv).

Caffeine-sulphonic Acid.—This compound, introduced by Drs. Heinz and Liebrecht, is claimed to stimulate the secreting power of the kidneys without increasing blood-pressure. It has been given in the form of a sodium combination, and, while acting as a good diuretic, had no ill effect upon the digestive processes. The salt is, therefore, well adapted to the treatment of cardiac or renal dropsy. Caffeine-sulphonic acid will also unite with lithium, and it is thought that this salt will prove useful in lithiasis, gout, and gravel.

CAJUPUTI OLEUM (U. S. P.).—**Oil of Cajuput.** (See **Oleum Cajuputi.**)

CALAMUS (U. S. P.).—**Calamus (Sweet Flag).**

Preparation.

Fluidextractum Calami (U. S. P.).—Fluid Extract of Calamus. Dose, 1 to 4 c.cm. (or *m*xv-f3j).

Pharmacology.—The dried, unpeeled rhizome of the Acorus calamus (Araceæ) is slightly aromatic and quite pungent to the taste, and is carminative. It contains a neutral, bitter glucoside, **Acorin**, a nitrogenous principle, a volatile oil, benzoic acid, etc.

Therapy.—In consequence of its feebly-aromatic taste, calamus is sometimes useful, and is popularly employed, in overcoming a tendency to flatulence, by chewing it slowly and swallowing the saliva. It is sometimes adopted as a substitute for tobacco, by those who desire to overcome the habit of chewing. It is a constituent in various "bitters" used as appetizers and stimulants. An infusion (31 Gm. to 473 c.cm., or ℥i-Oj) may be administered in wineglassful doses as a stomachic tonic.

CALCIUM.—**Calcium.**

U. S. P. Salts and Preparations.

Calx.—Lime. Calcium Oxide. Not used internally.

Calx Chlorinata.—Chlorinated Lime (available chlorine, at least 30 per cent.); often improperly called chloride of lime.

Calx Sulphurata.—Sulphurated Lime (Crude Calcium Sulphide). A mixture containing at least 60 per cent. of Calcium Monosulphide, together with unchanged Calcium Sulphate, and Carbon, in varying proportions. Dose, 0.015 to 0.13 Gm. (or gr. $^1/_4$-ij).

Calcii Bromidum.—Calcium Bromide. Dose, 0.65 to 4 Gm. (or gr. x-3j).

Calcii Carbonas Præcipitatus.—Precipitated Calcium Carbonate. Dose, 0.65 to 2.60 Gm. (or gr. x-xl).

Calcii Chloridum.—Calcium Chloride. Dose, 0.32 to 2 Gm. (or gr. v-xx).

Calcii Hypophosphis.—Calcium Hypophosphite. Dose, 0.65 to 2 Gm. (or gr. x-xxx).

Calcii Phosphas Præcipitatus.—Precipitated Calcium Phosphate. Dose, 0.65 to 2 Gm. (or gr. x-xxx).

Calcii Sulphas Exsiccatus.—Dried Calcium Sulphate. Contains 95 per cent., by weight, of calcium sulphate and about 5 per cent. of water. (Plaster of Paris for surgical purposes.)

Creta Præparata.—Prepared Chalk. Dose, 0.65 to 1.30 Gm. (or gr. x-xx).

Hydrargyrum cum Creta.—Mercury with Chalk (mercury, 38 Gm.; chalk, 57 Gm.; triturated together with honey and water and afterwards dried). Dose, 0.065 to 0.65 Gm. (or gr. i-x).

Linimentum Calcis.—Lime Liniment (equal parts of lime-water and linseed-oil). For external use (formerly known as carron-oil).

Liquor Calcis.—Solution of Calcium Hydroxide, or Lime-water. Dose, 15 to 60 c.cm. (or f℥ss-ij). A saturated solution containing not less than 0.14 per cent. of pure hydroxide of lime.

Mistura Cretæ.—Chalk Mixture (compound chalk-powder, cinnamon-water, and water). Dose, 4 to 15 c.cm. (or f℥i-iv).

Potassa cum Calce.—Potassa with Lime. Vienna or Caustic Paste (equal parts caustic potassa and lime).

Pulvis Cretæ Compositus.—Compound Chalk-powder (prepared chalk, 30 Gm.; acacia, 20 Gm.; sugar, 50 Gm.). Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Syrupus Calcis.—Syrup of Lime. Dose, 2 to 4 c.cm. (or f℥ss-j).

Syrupus Calcii Lactophosphatis.—Syrup of Calcium Lactophosphate. Dose, 4 to 16 c.cm. (or f℥i-iv).

Syrupus Hypophosphitum.—Syrup of the Hypophosphites (calcium, 45 Gm.; potassium, 15 Gm.; sodium, 15 Gm.; dilute hypophosphorous acid, 2 Gm.; spirit of lemon, sugar, and water to make 1000 c.cm.). Dose, 2 to 15 c.cm. (or f℥ss-iv).

Syrupus Hypophosphitum Compositus.—Compound Syrup of Hypophosphites (contains calcium hypophosphite, 35 Gm.; potassium hypophosphite, 17.5 Gm.; sodium hypophosphite, 17.5 Gm.; ferric hypophosphite, 2.25 Gm.; manganese hypophosphite, 2.25 Gm.; quinine, 1.1 Gm.; strychnine, 0.115 Gm.; sodium citrate, 3.75 Gm.; diluted hypophosphorus acid, 15 c.cm.; sugar and water to 1000 c.cm.). Dose, 4 to 15 c.cm. (or f℥i-iv).

B. P. Salts and Preparations.

Calx.—Lime (obtained by calcining chalk, lime-stone, or marble).

Calx Chlorinata.—Chlorinated Lime, containing 33 per cent. of available chlorine.

Calx Sulphurata.—Sulphurated Lime (a mixture containing not much less than 50 per cent. of calcium sulphide [CaS], with calcium sulphate and carbon). Dose, 0.015 to 0.065 Gm. (or gr. $^1/_4$-j).

Calcii Carbonas Præcipitatus.—Precipitated Calcium Carbonate (Precipitated Chalk). Dose, 0.65 to 4 Gm. (or gr. x-lx).

Calcii Chloridum.—Calcium Chloride. Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Calcii Hydras.—Calcium Hydroxide (Slaked Lime).

Calcii Hypophosphis.—Calcium Hypophosphite. Dose, 0.65 to 2 Gm. (or gr. x-xxx).

Calcii Phosphas.—Calcium Phosphate. Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Creta Præparata.—Prepared Chalk. Dose, 0.65 to 4 Gm. (or gr. x-lx).

Hydrargyrum cum Creta.—Mercury with Chalk. Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Liquor Calcis.—Solution of Lime (Lime-water). Dose, 30 to 120 c.cm. (or f℥i-iv).

Liquor Calcis Chlorinatæ.—Solution of Chlorinated Lime (3 per cent. of available chlorine). Dose, 1.20 to 4 c.cm. (or *m*xx-f℥j).

Liquor Calcis Saccharatus.—Saccharated Solution of Lime (calcium hydroxide, 50 Gm.; refined sugar, 100 Gm.; distilled water, 1000 c.cm.). Dose, 1.20 to 4 c.cm. (or *m*xx-lx). Contains about 2 per cent. of calcium hydroxide.

Linimentum Calcis.—Liniment of Lime (equal parts of lime-water and olive-oil).

Lotio Hydrargyri Flava.—Yellow Wash (corrosive sublimate, 0.46 Gm.; lime-water, 100 c.cm.).

Lotio Hydrargyri Nigra.—Black Wash (calomel, 0.685 Gm.; glycerin, 5 c.cm.; tragacanth mucilage, 12.5 c.cm.; lime-water, q. s. ad 100 c.cm.). For external use.

Mistura Cretæ.—Chalk Mixture. Dose, 15 to 30 c.cm. (or f℥ss-j).

Pulvis Cretæ Aromaticus.—Aromatic Powder of Chalk (cinnamon-bark, 80 Gm.; nutmeg, 60 Gm.; cloves, 30 Gm.; cardamom-seeds, 20 Gm.; sugar, 500 Gm.; prepared chalk, 220 Gm.). Dose, 0.65 to 4 Gm. (or gr. x-3j).

Pulvis Cretæ Aromaticus cum Opio.—Aromatic Powder of Chalk with Opium (containing 0.065 Gm., or gr. j, of opium in 2.60 Gm., or gr. xl). Dose, 0.65 to 1.30 Gm. (or gr. x-xx).

Syrupus Calcii Lactophosphatis.—Syrup of Calcium Lactophosphate. Dose, 4 to 16 c.cm. (or f3i-iv).

Pharmacology.—Lime is an alkaline earth which is usually obtained by calcining any native calcium carbonate, such as chalk, limestone, or marble, driving off the CO_2 and leaving calcium oxide, which, when fresh from the lime-kilns, is in large, hard, grayish-white masses. In this state it is known as quicklime, which has a great affinity for water, even slowly taking it from the air. Under the influence of moisture, lime generates heat and breaks up into a wet powder, which is a mixture of calcium oxide and calcium carbonates, and constitutes slaked line. When this is mixed with three or four parts of water, the product is called "milk of lime." It is alkaline in taste and reaction. Calcium oxide is only slightly soluble (1-760) in cold, and even less so in hot water. Chalk, or calcium carbonate, is a valuable antidote in cases of poisoning by carbolic, sulphuric, or oxalic acid. It is found in the household in tooth-powder, convenient for prompt administration.

Physiological Action.—Some preparations of lime are sedative, others astringent or caustic; quicklime is irritating and caustic to mucous membranes. Lime-water and chalk are astringent and alkaline; they reduce the acidity of the contents of the alimentary canal, thus relieving irritation, and also exert a slightly astringent effect. In patients suffering from deficiency of lime in the food, lime-water is a useful and acceptable remedy, and may be continued for a long time. Calcium phosphate serves an important function in promoting the nutrition of the motor apparatus,—bone, cartilage, tendon, and muscle. The presence of a certain proportion of lime-salts in the blood is essential to general nutrition. When this amount is reduced, disturbances arise, affecting particularly the bony and lymphatic glandular systems. Calcium chloride is more of an irritant; it has a reputation for its influence as an alterative. Potassa with lime, or Vienna paste, is used in surgery as a caustic. According to the investigations of M. Binet, the salts of the alkaline earths are capable of causing respiratory and cardiac affections, from which death may directly ensue. They may also cause derangement of the gastro-intestinal system. Eventually they may occasion loss of nervous excitability and muscular contractility. Toxic doses of calcium arrest the heart in systole. Calcium exerts a special action upon the nervous system, occasioning a condition of torpor with preservation of reflex excitability and sensibility.

Therapy.—Lime is an ingredient in depilatory powders, which are now superseded by the process of removal of hair by electrolysis. Freshly-slaked lime absorbs the products of decomposition, and is used as a disinfectant in cess-pools, manure-heaps, etc.; but the chlorinated lime, which prevents decomposition by virtue of the available chlorine, is far better. In the treatment of onychia maligna, Professor Vanzetti recommends the application of

caustic lime. Lime-water is a stimulating dressing for wounds and ulcers, and, combined with oil, is used as a dressing for burns. Carron-oil consists of linseed-oil and lime-water. It is suggested that the addition of $^1/_2$ to 1 per cent. of thymol augments the value of carron-oil by rendering it an antiseptic application. A better dressing is made by beating up lard (unsalted) with lime-water and adding a few drops of oil of bitter almonds. A very good prescription to use in burns will be:—

℞ Calcis præcip. ..... 4| Gm. or ʒj.
Phenolis liquefact. ..... 8| Gm. or ʒij.
Ol. olivæ,
Aquæ calcis .....aa 150| c.cm. or fʒv.—M.

Carron-oil also relieves pain caused by the stings of wasps and other insects. According to Dr. Joseph Bell, applied to the face on a mask of cotton-wool, it will decidedly diminish the pitting in small-pox.

Lime-water is of undoubted value alone, or combined with glycerin, in the treatment of acute vesicular eczema. It may be employed for this as well as other varieties of eczema, especially when the surface is dry and irritable, with very great relief. Pruritus, which often becomes intolerable in eczema and other inflammatory affections of the skin, and itching present in old persons, may be relieved or cured by the application of lime-water, with rose-water, glycerin, or one of the oils. A very suitable application in the diseases just referred to is:—

℞ Liquor calcis ..... 90| c.cm. or fʒiij.
Creosoti ..... 60 c.cm. or *m*x.
Pulveris zinci carb. (impur.)..... 31| Gm. or ʒj.
Glycerini vel ol. olivæ. ..... 90| c.cm. or fʒiij.
M. Sig.: Shake well and mop over the surface.

For the relief of pruritus ani, Dr. A. L. Berger advises the use of a pledget of cotton-wool soaked in the solution of chlorinated lime and introduced into the bowel. In seborrhœa, hyperidrosis, bromidrosis, and in bruises of the skin and deeper structures, the preparations of calcium are often used with great benefit. The following are excellent combinations:—

℞ Calcii carb. præcip..... 31| Gm. or ʒj.
Glyceriti boroglycerinæ..... 15| c.cm. or fʒss.
M. Sig.: Smear over the parts bruised.

℞ Calcii chloridi,
Calcii carb. præcip.,
Pulv. amyli ..... aa 31| Gm. or ʒj.
M. Sig.: Dust over the surface, especially in oily conditions of the skin and in excessive and fetid perspiration.

Prepared chalk is employed very largely, alone as well as an ingredient of many very good dentifrices, on account of its antacid, astringent, and sedative action upon the gums and the mucous membrane of the buccal cavity. Garretson recommended the appended formula as being a good tooth-powder:—

℞ Cretæ prepar.,
Pulv. iridis Flor. ..... aa 15|5 Gm. or ʒss.
Pulv. ossis sepiæ ..... 8| Gm. or ʒij.
Olei limonis ..... q. s.—M.

Prepared chalk is a good dusting-powder in intertrigo and hyperidrosis, and may be used upon the surface of ulcers as a protective dressing.

The preparations of calcium are especially useful in childhood because of the deficiency of lime in the food of many children. Lime-water added to milk gives material for bones and teeth, improves nutrition, and overcomes a tendency to rickets. It relieves irritability of the stomach and vomiting.

The syrup of lime, or the English saccharated solution of lime, contains more of the base than the solution, and is a convenient antidote to poisoning by oxalic, sulphuric, and other mineral acids. In children's diarrhœa, often due to sour stomach, chalk mixture is very useful, and may be combined with an antiseptic and opiate:—

℞ Creosoti	24	c.cm. or *m*iv.
Tinct. opii camph.	4	c.cm. or f3j.
Mist. cretæ	q. s. ad 60	c.cm. or f3ij.

M. Sig.: A teaspoonful every two hours to a child two years old.

The same mixture is useful in adults, with corresponding increase of dose and the addition of a decided astringent, such as tincture of kino, or fluid extract of coto-bark.

The following combination is said to be useful in phthisis and chronic pulmonary affections:—

℞ Creosoti	10	c.cm. or f3ii*m*xl.
Alcoholis (90 per cent.)	90	c.cm. or f3iij.
Calcii phosphat.	19·5	Gm. or 3v.
Aquæ destillata	18·5	c.cm. or f3v.
Syrupi	105	c.cm. or f3iiiss.
Vini alba (Malaga)	q. s. ad 1000	c.cm. or Oi.f3ij.—M.

Each tablespoonful contains about 0.16 c.cm. (or *m*iiss) of creosote and 0.32 Gm. (or gr. v) of monocalcic phosphate.[1]

Other very effective prescriptions containing lime are:—

℞ Calcii carbonatis præcipitati	12	Gm. or 3iij.
Tincturæ gambir	30	c.cm. or f3j.
Tincturæ opii	7·5	c.cm. or f3ij.
Spiritus chloroformi	15	c.cm. or f3iv.
Pulveris acaciæ	8	Gm. or 3ij.
Aquæ menth. pip.	195	c.cm. or f3viss.

M. Sig.: One or two teaspoonfuls in water every hour or two, for acute diarrhœa.

℞ Liquor calcis,		
Fluidext. coto corticis,		
Syrup. acaciæ	aa 30	c.cm. or f3j.

M. Sig.: From one to two teaspoonfuls in water or milk every three or four hours, for chronic diarrhœa.

Special Applications.—In the diarrhœa of relaxation in young children lime-water alone may be sufficient where the motions are too frequent and watery and acid in their reaction. It is also used per enema against thread-worms, and it may be given as an injection in leucorrhœa. In diphtheria much relief is experienced from the use of a spray of lime-water, preferably with the steam-atomizer, directed to the fauces, or from inhaling the vapors from slaking lime; it is claimed that the lime loosens the false membrane

[1] *Journal des Praticiens*, Feb. 24, 1900.

and partially dissolves it. It is also useful in the same manner in croup and plastic bronchitis. The vapor obtained from chlorinated lime is advantageously inhaled in hay fever. In adults, where it is desirable to administer milk, it is often found necessary to add lime-water to it to prevent curdling. In the artificial feeding of infants the addition of lime-water to cows' milk is of decided service by rendering the curd more soft and flaky, and consequently more easy of digestion. Milk and lime-water will not infrequently relieve gastralgia, and even, in some instances, the pain of gastric carcinoma. In the latter affection it also allays the vomiting. The prolonged administration of lime-water renders the urine alkaline, and hence it may prove useful in lithiasis. It has been shown that, under the same circumstances, carbamic acid may appear in the urine. The acid is united to the lime and causes the fluid to emit an ammoniacal odor. In combination with opium and aromatics, as in the pulvis cretæ aromaticus cum opio of the British Pharmacopœia, chalk is of great value in diarrhœa. The carbonate of calcium is likewise beneficial in diarrhœa, and, finely powdered, is a good application in intertrigo and acute eczema. Calcium phosphate is useful in rickets; also in anæmia, general debility, diarrhœa, in small doses, given frequently; it appears to have a stimulating effect upon the liver, and should be given in preference to mercury to infants with clay-colored stools, and in jaundice. The anæmia due to profuse suppuration, or to lactation, may be remedied by the administration of this salt. It is advantageous, moreover, in mollities ossium, delayed union of fractured bone, caries and necrosis, and scrofulous inflammation of the lymphatic glands. The hydrated phosphate has been warmly recommended as relieving the sickness of pregnancy.

Calx sulphurata is useful in styes, acne, and furuncles; given in 0.015 to 0.03 Gm. (or gr. $^1/_4$-ss) doses several times a day, it hastens maturation of pustules. If given early, it prevents the formation of pus, but, if suppuration has occurred, calcium sulphide limits its extent and favors early and complete evacuation. This combination is serviceable in both acute and chronic eczema. It is likewise beneficial in the suppuration of scrofulous glands. Dr. Frank P. Norbury finds it useful in acute tonsillitis, especially of strumous patients, with a tendency toward rapid suppuration. It prevents or limits the formation of pus. Dr. Witherle, of St. Paul, states that calcium sulphide is beneficial in the early stage of pulmonary tuberculosis, given in doses as large as can be tolerated. The swelling of the upper lip and tip of the nose so often seen in scrofulous children may be decidedly improved by the exhibition, night and morning, of 0.015 Gm. (or gr. $^1/_4$) doses of calcium sulphide. In diphtheria, during the period when the membrane is loosening and suppuration is taking place, Phillips recommends the administration of this salt in doses of 0.01 to 0.015 Gm. (or gr. $^1/_6$-$^1/_4$) every hour or every two hours. A case of elephantiasis has been reported in which this salt was successfully employed.

It is given with good effects in ophthalmia and sores in scrofulous children. Calx sulphurata is the official equivalent of calcium sulphide, which has been used in conjunction with defervescents by Dr. T. M. Lloyd, of Brooklyn, N. Y., in measles and scarlatina, with the apparent result of abridging the course of the fever. In pertussis the same remedy reduced the number and severity of paroxysms. It was administered in doses of 0.03 Gm. (or gr. ss) half-hourly to children between two and five years of age. Rubbed

up with sugar of milk it was taken without repugnance. This salt will occasionally produce an eruption of vesicles, pustules, and furuncles. Dr. A. M. Osness advocates the treatment of diphtheria by local swabbing with a mixture of carbolic acid, tincture of chloride of iron, and alcohol, and the internal administration of calcium sulphide, 0.05 Gm. (or gr. $^3/_4$), every half-hour for a period of thirty-six hours, water being taken freely to help elimination of the toxin.

Calcium chloride (not calx chlorata) is given, well diluted, in glandular enlargements, and is said to be curative in eczema and lupus; it is claimed that it aids cicatrization in tubercular ulcerations, and is useful in chorea and colliquative diarrhœas in strumous children. Calcium chloride allays vomiting produced by the presence of sarcinæ ventriculi.

Dr. Crombie, of the East Indian medical service, has found calcium chloride efficacious in the treatment of boils and pneumonia. Dr. A. E. Wright has ascertained by experiment that the addition of calcium chloride to blood renders coagulation more rapid. He has given the salt internally with advantage in a case of hæmophilia, and suggests that it will prove useful in the treatment of internal hæmorrhage and aneurism. He has known it to arrest an obstinately-recurring epistaxis and a severe hæmoptysis. In a case of hæmatemesis and gastro-intestinal hæmorrhage in a child 4 days old, L. A. Parry[1] gave frequent doses of 0.32 Gm. (or gr. v) of calcium chloride every hour during the day and every two hours at night. The child took 10.35 Gm. (or 160 grains) in three days, when the medicine was discontinued because bleeding had ceased for twenty-four hours. In cases of hæmophilia requiring surgical operation, great advantage has been observed from the administration of calcium chloride for a few days previous to operation, for reducing the bleeding.

Dr. S. Solis-Cohen prefers the calcium chloride to any other drug in the treatment of hæmoptysis, administering it in doses of 0.65 to 1 Gm. (or gr. x-xv) every second hour in glycerin, simple elixir, and water, or infusion of gentian. Dr. Saundby has employed the same salt with success in purpura hæmorrhagica, administering 0.38 Gm. (or gr. vj) every two hours during the day. Sir J. Sawyer has employed the chloride in chronic pulmonary tuberculosis with good results, and states that in addition to its other advantages it will often suppress night-sweats. Both the chloride and the carbonate have been serviceably given in order to restrain hæmorrhage caused by a fibroid tumor, and to check menorrhagia.

Calcium hypophosphite has a special reputation for the treatment of phthisis, and is a useful tonic in such cases. The official syrup of the hypophosphites, in appropriate cases, is one of the best general systemic tonics that we possess. It may be substituted by the following, when more strychnine or iron is desired:—

℞ Syrup. ferri lactatis .....
Syrup. hypophosphitum .....aa 120 | c.cm. or f℥iv.
Strychninæ sulphatis ..... | 015 Gm. or gr. $^1/_4$.
M. Sig.: A half-tablespoonful in water three times a day.

Calcium bromide was brought forward, by Hammond, as a substitute for bromide of potassium in cases where the depressing effects of the latter

[1] *The Lancet*, July 16, 1898.

would forbid its use, such as epilepsy or chorea in anæmic subjects (in doses of 2 to 8 Gm., or 3ss-ij). Professor Germain Sée regarded both the bromide and chloride as advantageous in the treatment of dyspepsia and many diseased conditions of the stomach. This salt would, however, seem well adapted to fulfill the indications of a bromide in rachitic subjects. The bromide is held to contain one-sixth more bromine than the potassium bromide. Hugh Woods prefers the calcium oxyiodides to the other iodine preparations, as containing more iodine. According to the testimony of Dr. Beebe, who is corroborated by Dr. Lawrence, idodized calcium is of service in membranous croup. These writers advise that 0.01 to 0.02 Gm. (or gr. $^1/_6$-$^1/_3$), dissolved in water, should be given every fifteen, thirty, or sixty minutes, according to the severity of the symptoms. Grube reported[1] good results in diabetes mellitus from the "egg-shell" treatment, the patient taking a teaspoonful of powdered egg-shell daily. This is also useful in boils. He has suggested a powder in imitation of egg-shells for the same purpose and reports very encouraging results. Grube's powder contains calcium carbonate, 93 parts; with calcium phosphate and magnesium phosphate, each, 3 $^1/_2$ parts. Of this 4 Gm. (or 3j) are to be taken daily. The syrup of calcium lactophosphate (made by dissolving calcium phosphate in lactic acid, with orange-flower water and syrup) is a pleasant and very useful remedy for improving nutrition in young children, especially if there be a scrofulous taint. It contains about 0.75 Gm. (or gr. xij) of calcium phosphate in each ounce. It is also a valuable agent in treating many skin diseases due to malnutrition. This combination may be advantageously prescribed, in vesicular emphysema, chronic bronchitis, phthisis, debility, and wasting diseases, thus:—

℞ Syrup. calcii lactophosphatis	90	c.cm. or f℥iij.
Olei gaultheriæ	2	c.cm. or *m*xxx.
Pulveris acaciæ	4	Gm. or 3j.
Liquor pancreatici	30	c.cm. or f℥j.
Olei morrhuæ	150	c.cm. or f℥v.

M. et ft. emulsio.
Sig.: A tablespoonful three times a day.

Dr. H. V. Knaggs ascribes valuable antispasmodic properties to calcium sulphite, in spasmodic diseases. He gives 0.003 Gm. (or gr. $^1/_{20}$) to a child one year old, suffering with convulsions from dentition, meningitis, and even acute tuberculosis. A saturated aqueous solution of the bisulphite is an excellent non-poisonous disinfectant. The preparations of chalk, if given in large doses for a considerable period of time, may form intestinal concretions. Calcium salicylate, a salt which is soluble in water, has been recommended as a remedy in diarrhœa, especially that of children. The dose is from 0.50 to 1.30 Gm. (or gr. viii-xx), and it is given either alone or combined with bismuth salicylate. It is a white, odorless, and tasteless crystalline powder.

Calcium carbide has been used in inoperable cancer of the uterus by Grusdew, of St. Petersburg, for its caustic action when brought in contact with water and the disinfecting properties of the acetylene. Under its use hæmorrhage has been checked and the ulcerative processes retarded.

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[1] *Therapeutische Monatschefte*, May, 1896.

Calcium Eosolate is a sulphosalt of the aliphatic creosote esters, and is said to contain 25 per cent. of creosote. Its formula is given as $(C_9H_7S_3O_{12})_2Ca_3$. In large doses it produces griping pains in the intestines, with diarrhœa. The therapeutic dose is from 0.25 to 0.65 Gm. (or gr. iv-x) three or four times a day. It is a grayish powder, feeling to the touch like finely-pulverized pumice-stone. Its odor is slightly pungent and somewhat ethereal, its taste a little acrid and leathery. It is soluble in from 8 to 10 parts of cold and in 7 parts of hot water. It is very slightly soluble in alcohol, and insoluble in chloroform and turpentine, but is readily dissolved by hydrochloric, citric, and by some other organic acids, while it dissolves only slowly in acetic acid.

Dr. Heinrich Stern,[1] of New York City, gives the history of a remarkable case of diabetes inspidus, in a boy of sixteen years, who was passing over one and one-half gallons of urine per day that had a specific gravity lighter than water. He was dwarfed in stature to that of a child of seven years, and for a long time had shown no signs of development. Under the calcium-eosolate treatment, in conjunction with 3 c.cm. (or *m*xlv) doses of fluid extract of ergot four times a day, he for the first time in years steadily began to increase in weight, lost his nervousness, the hydruria gradually diminished; though occasional increases occurred for a brief period, there was an increase in the excretion of solids, and thirst was diminished. At the time of the report the patient still continued to improve.

Five cases, reported by Dr. Stern, of diabetes mellitus under treatment with calcium eosolate and a milk diet ceased excreting dextrose, gained in weight, and improved otherwise. One of the cases at a later date died of endocarditis. Ten cases of phthisis showed decided signs of improvement under small doses of the eosolate in conjunction with other remedies.

CALENDULA (U. S. P.).—**Marigold.**

Preparation.

Tinctura Calendulæ (U. S. P.).—Tincture of Calendula (20 per cent.). Dose, 2 to 4 c.cm. (or f3ss-j).

Pharmacology and Therapy.—The dried ligulate florets of Calendula officinalis (Compositæ) contain **Calendulin,** a volatile oil, an amorphous bitter principle, yellow coloring matter, etc. It is used as an emmenagogue and as a diaphoretic, in recent infusion. In the form of tincture, it is reputed to be tonic, antispasmodic, and alterative, and may be employed locally as a revulsive in sprains, bruises, or in superficial burns and scalds, resembling arnica in its applications, though less active.

CALUMBA (U. S. P.).—**Calumba (Columbo).**
CALUMBÆ RADIX (B. P.).—**Calumba-root.**
Dose, 0.32 to 0.65 Gm. (or gr. v-x).

Preparations.

Fluidextractum Calumbæ (U. S. P.).—Fluid Extract of Calumba. Dose, 1 to 2 c.cm. (or *m*xv-xxx).

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[1] *Journal of the American Medical Association*, xxxiv, p. 467.

Tinctura Calumbæ (U. S. P., B. P.).—Tincture of Calumba. Dose, 4 to 7.5 c.cm. (or f3i-ij).

Liquor Calumbæ Concentratus (B. P.).—Concentrated Solution of Calumba (calumba, 500 Gm.; alcohol [90 per cent.], 225 c.cm.; distilled water, q. s. ad 1000 c.cm.). Dose, 2 to 4 c.cm. (or f3ss-j).

Infusum Calumbæ (B. P.).—Infusion of Calumba (5 per cent.). Dose, 15 to 30 c.cm. (or f3ss-j).

Pharmacology.—The dried root of Jateorrhiza palmata (Menispermaceæ) (U. S. P.); Jateorrhiza Columba (B. P.) of Africa contains, among its constituents, berberine, calumbin, calumbic acid, and starch. It is free from tannin, and therefore its preparations may be combined with iron.

Physiological Action and Therapy.—In composition and physiological action calumba resembles quassia and gentian, though lighter and more agreeable than some of the other remedies of this class, and more acceptable to the stomach. As a bitter tonic, calumba may be used during convalescence, or in atonic dyspepsia or other enfeebled constitutional conditions. It is believed to be somewhat sedative and antispasmodic; in cases where this quality is required it would be better to use the fluid extract or powder than the tincture. A small dose of the tincture or infusion of calumba will often relieve nausea and vomiting. Atonic diarrhœa is benefited by calumba. When the tincture is prescribed as an appetizer, the danger of forming the alcohol habit should be kept in mind:—

℞ Ext. calumbæ	13 Gm. or gr. ij.
Sodii bicarb.	65 Gm. or gr. x.
Pulv. rhei	32 Gm. or gr. v.
Pulv. zingiberis	65 Gm. or gr. x.

M. et ft. chart. Mitte tales no. xxx.
Sig.: Take one before each solid meal, for weak digestion.

As a good carminative mixture Dr. Crutchfield prescribes:—

℞ Tr. calumbæ	11	c.cm. or f3iij.
Sp. ammon. aromat.	6	c.cm. or f3iss.
Tr. cardam. co.	q. s. ad 90	c.cm. or f3iij.

M. Dose: Tablespoonful in water as required.

Dr. Schultz has had very good results from the tincture of calumba in the treatment of gastric catarrh. Calumba has been especially recommended as a valuable tonic in convalescence from influenza. Dr. A. F. Myers,[1] of Blooming Glen, Pa., considers calumba as the best of the vegetable tonics; both as a stomachic in mild forms of dyspepsia and as a general corroborant in the convalescent stage of acute diseases and in general debility.

CAMBOGIA (U. S. P., B. P.).—**Gamboge, Pipe Gamboge.**
Dose, 0.006 to 0.20 Gm. (or gr. $^1/_{10}$-iij).

Preparation.

Pilula Cambogiæ Composita (B. P.).—Compound Pill of Gamboge (containing gamboge, Barbadoes aloes, compound cinnamon powder, of each, 1 part; hard soap, 2 parts; with syrup of glucose, 1 part. Mix to form a mass). Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

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[1] *Medical and Surgical Reporter*, May 16, 1898.

Pharmacology.—Gamboge is a gum-resin, obtained from the Garcinia Hanburri (Guttiferæ) : a tree of Siam. It consists largely of cambogic acid (73 per cent.), and is partly soluble in alcohol and ether, and forms an emulsion with water. It has no official preparations in the United States Pharmacopœia, and is rarely administered by itself, but is a constituent of the compound cathartic pill (each pill containing 0.015 Gm., or gr. $^1/_4$, of gamboge).

Physiological Action.—Gamboge is not a systemic, but a local, irritating purgative. It is at first insipid, but afterward produces an acrid taste, with increased secretion of saliva. In the intestinal tract, it has a drastic, hydragogic, cathartic effect. It stimulates the intestinal glands, but not the liver (Rutherford), and is also believed to have some power as a diuretic, as it imparts a bright-yellow color to the urine. It carries off the bile in the intestinal canal and prevents reabsorption. Large doses cause vomiting and gastro-enteritis.

Therapy.—Gamboge has no local effect beyond staining the skin. It was formerly used in cardiac dropsy as an hydragogic cathartic to carry off large quantities of fluid and promote absorption, but the compound jalap-powder accomplishes this result more quickly, agreeably, and certainly. The compound cathartic pill is a good remedy for constipation and at the beginning of the treatment of malarial poisoning. In minute doses (0.006 Gm., or gr. $^1/_{10}$, every hour or two) it is claimed that gamboge affords much relief in flatulence and intestinal indigestion.

CAMELLIA. — Tea. The extemporaneously-prepared infusion of the dried leaves of Camellia thea (Ternstrœmiaceæ), or Chinese tea-plant, is now so widely used at the table as a beverage that it has given its name to the evening meal. It contains caffeine (or theine), theophylline (Rossel),[1] a volatile oil, tannin, etc. Green tea is made from the younger leaves, dried with a moderate heat, so as to retain their color (sometimes fraudulently colored with Prussian blue, turmeric, and copper), while the black tea is made of the older leaves, and contains more tannin. (See **Caffeina**, page 284).

Physiological Action and Therapy.—The effects of tea are not fully represented by caffeine; probably theophylline, which is isomeric with theobromine, and the volatile oil assist in producing its physiological action upon the system. Dr. Thomas H. Mays claims that the physiological action of caffeine derived from Camellia is different in its effects from that of coffee. It is an antidote to narcotic poisoning by virtue of its caffeine, and to antimony and many alkaloids on account of its tannin; it is also a physiological antidote to agents which depress nerve-function or the heart. In small doses infused with boiling water, tea is an agreeable stimulant, removing a sense of fatigue and giving a feeling of well-being. It is useful in headache from overwork or worry, and will often relieve migraine. Tea is an accessory food, but, on account of its convenience, it often becomes the principal article of food for persons who think that they cannot spare time to prepare a full meal, or have not the appetite to eat it. In many cases of what has been called tea-drinkers' dyspepsia, in sewing women, it is found, upon inquiry, that the tea is drunk with every meal, and that very little food is taken with

[1] *Zeitschrift für Physiologische Chemie. Therapeutic Gazette*, March 15, 1890.

it except bread or hot biscuit. Such cases of debility, palpitation of the heart, flatulence, anorexia, constipation, etc., are not really instances of "theism," but cases of starvation and chronic indigestion, and require good food, sunlight, exercise, and tonics. Men who deal in tea, and constantly taste it, only exceptionally show symptoms of nerve-disorder ascribable to this cause; even then it may be due to idiosyncrasy, for persons have different degrees of susceptibility to the effects of tea. Some cannot use it at all; others are proof, apparently, against any ill effects. Many can drink black tea who cannot stand the effects of green tea. Strong green tea may embarrass digestion and give rise to constipation. Tea may also diminish the tendency to sleep and in people of highly-nervous temperament may cause obstinate wakefulness. Ordinarily, the moderate use of tea relieves fatigue and disposes to mental cheerfulness.

Theocine, or synthetic theophylline, has been used with good results as a cardio-vascular stimulant, and also as a diuretic in dropsy. It acts chiefly upon the secreting function of the kidney. It relieves air-hunger in cardiac dyspnœa or asthma. Dose, 0.25 to 0.30 Gm. (or gr. iv-v), given usually with sodium acetate.

CAMPHORA (U. S. P., B. P.).—**Camphor** ($C_{10}H_{16}O$).
Dose, 0.065 to 0.32 Gm. (or gr. i-v).

ACIDUM CAMPHORICUM (U. S. P.).—**Camphoric Acid.**
Dose, 0.30 to 2 Gm. (or gr. v-xxx).

Preparations.

Ceratum Camphoræ (U. S. P.).—Camphor Cerate.

Camphora Monobromata (U. S. P.).—Monobromated Camphor. Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Aqua Camphoræ (U. S. P., B. P.).—Camphor-water (U. S. P. contains 8 Gm. to 1000 c.cm., or gr. iv-f℥j). Dose, 4 to 15 c.cm. (or f3i-iv).

Spiritus Camphoræ (U. S. P., B. P.).—Spirit of Camphor (10 per cent.). Dose, 0.30 to 1.20 c.cm. (or *m*v-xx).

Linimentum Camphoræ (U. S. P., B. P.).—Camphor Liniment, Camphorated Oil (camphor, 20; cottonseed-oil, 80 parts). External use. (In B. P. olive oil is used.)

Linimentum Camphoræ Ammoniatum (B. P.).—Ammoniated (or Compound) Liniment of Camphor (camphor, 50 Gm.; oil of lavender, 2.5 c.cm.; strong solution of ammonia, 100 c.cm.; alcohol [90 per cent.], a sufficient quantity to make 400 c.cm.).

Tinctura Camphoræ Composita (B. P.).—Compound Tincture of Camphor (Paregoric, or Paregoric Elixir: tincture of opium, with benzoic acid, camphor, oil of anise, and alcohol). Each 4 c.cm. (or drachm) contains the equivalent of 0.015 Gm. (or gr. ¼) of opium, or nearly 0.5 milligramme of anhydrous morphine in each cubic centimetre. Dose, 2 to 4 c.cm. (or f3ss-j).

Camphor is a constituent in the following official preparations: Camphorated tincture of opium, compound morphine powder, and cerate of subacetate of lead (U. S. P.); soap, belladonna, and chloroform liniments (U. S. P., B. P.); compound tincture of camphor and mustard liniment (B. P.).

Pharmacology.—Camphor is "the dextro-gyrate modification of the saturated ketone $C_9H_{16}CO$, obtained from Cinnamomum Camphora (Laurineæ), and purified by sublimation." The tree is a native of the East Indies and China. It contains a solid, volatile, fatty substance, or stearopten, which exists in all parts of the plant and crystallizes naturally in the wood and under the bark. As collected by natives, it is called crude camphor, which is subsequently purified and sublimed in this country. Camphor comes in white, translucent, partly-crystalline masses, of penetrating, aromatic odor and a

cool, acrid taste. It is lighter than water, in which it is very sparingly soluble, but is readily dissolved by alcohol and ethereal substances. Camphor is quite soluble in milk, which may often, therefore, be used as a convenient vehicle. It is easily ignited and burns with a smoky flame. With chloral-hydrate, camphor combines when triturated, forming an oily liquid. When three parts of camphor are rubbed with one part of crystallized carbolic acid, a clear liquid is formed. Camphor cannot be powdered by trituration alone, but can be when moistened with alcohol, chloroform, or ether.

Physiological Action.—When applied to the skin, camphor slightly irritates and reddens the surface, and probably diffuses through into the deeper structures, so as to exert a local sedative effect. In considerable doses, camphor causes vertigo and confusion of ideas, diaphoresis, delirium, or stupor, followed by epileptiform convulsions and maniacal excitement. There is lowering of the reflex excitability of the spinal cord and muscular weakness. In some cases the first manifestation of its toxic action has been a sudden loss of consciousness with or without convulsions. Upon the circulation a stimulating effect is observed from small doses and the arterial tension is raised, but larger doses cause prostration and weakness of the heart's action Camphor is antispasmodic, and is a valued sedative in allaying abnormal nervous excitability often encountered in women, especially in cases where opium disagrees or is undesirable. It is, in full doses, a sedative to the generative functions and allays pain attending menstruation. Poisoning has followed the use of a saturated solution in alcohol (Rubini's tincture, or so-called "mother-tincture"), which should not be used for internal administration as so small a quantity as 0.50 c.cm. (or *m*vij) has produced poisonous effects. Toxic doses give rise to inflammation of the stomach. In cases of poisoning, if any of the drug remain in the stomach it should be removed by the stomach-tube, the patient allowed to drink cold water freely containing magnesium sulphate (31 Gm., or ℥j), and the symptoms combated with arterial stimulants and hypodermic injections of morphine and atropine. Camphor is eliminated by the kidneys, lungs, and sudoriparous glands.

Therapy.—Camphor is highly prized in the household, for headaches and various neuralgic pains, the spirit, or "Eau Sedative,"[1] being applied upon a handkerchief or a flannel bandage. It is also a common ingredient in popular liniments. Camphor-chloral is used in neuralgia and myalgia as a rubefacient and anodyne. It dissolves morphine readily:—

℞ Morphinæ sulphat. ..... 1|30 Gm. or gr. xx.
Camphor-chloral. ..... 8| Gm. or ℥ij.—M.
For local application to painful spots.

Cavazzani applies to chancroids, with excellent results, a mixture of 5 parts of chloral hydrate, 3 of camphor, and 25 of glycerin.

A combination of camphor and carbolic acid (3 to 1) is a valuable antiseptic dressing for wounds, the odor being more pleasant than that of carbolic acid, and, the solution being anodyne, it cannot be diluted with water or glycerin, but mixes with oil or alcohol. It is a beneficial application in herpes and erysipelas, in vaginitis, vulvitis, and paræsthesia of the vulva.

[1] The *Aqua Sedativa* (N. F.) consists of ammonia water, 125 c.cm. (or f℥iv); spirit of camphor, 12 c.cm. (or f℥iij); sodium chloride, 65 Gm. (or ℥ij gr. lxxiv); and water sufficient to make 1000 c.cm., or two pints. This is also known as "*Eau Sedative de Raspail.*"

This liquid overcomes the fœtor of lochial discharges. On account of its anæsthetic properties it is useful in the treatment of inverted toe-nail. It has been successfully given by the mouth in doses of 0.30 to 0.60 c.cm. (or gtt. v-x) for the relief of gastric and intestinal catarrh. Carbolic-acid camphor is a serviceable local remedy in pharyngitis or tonsillitis. Paræsthesia may often be relieved by the topical use of this agent, either in its pure state or weakened by some suitable excipient.

Salol and camphor, and betanaphtol and camphor, also form fluids having valuable antiseptic powers. By mixing equal parts by weight of camphor and absolute alcohol, and dissolving pyroxylin in the solution (in the proportion of 1 to 40), an excellent substitute for collodion is obtained. Camphoid is the name given to the fluid, and it is also a good solvent for salicylic acid, carbolic acid, and iodoform. Camphoid forms, in drying, an elastic film, which is not dissolved by water and is a good coating for abrasions, superficial wounds, etc. A mixture of equal parts of camphor and menthol diluted with a mineral oil has been used successfully by Dr. Seth S. Bishop, in a 10-per-cent. solution, in acute nasal catarrh and laryngitis. In hypertrophic rhinitis a 25-per-cent. solution can be used. A 3- to 5-per-cent. solution is sufficiently strong for injection into the ear for disease in the tympanum.

A solution of camphor in ether (30 to 180) has been applied to erysipelatous inflammation with benefit. Camphor has been used for the purpose of aborting boils. The seat of inflammation is touched three times a day with an alcoholic solution, and, after this has evaporated, the surface is covered with camphorated oil. Powdered camphor, likewise, is an efficient application to indolent ulcers, and has been used with success upon specific ulcers of the genitals. Inhalation of a solution of camphor in cologne-water gives relief in that form of headache, which may occur at the menopause. Camphor and morphine, locally introduced or applied externally on a hot flaxseed poultice, allays toothache. A liniment or ointment containing camphor is useful in chilblains. The camphor ointment of the National Formulary (camphor, 22; white wax, 11; lard, 67 parts) may be used as an application to indolent ulcers. Camphor, either alone or combined as follows, yields serviceable antipruritics in eczema and paræsthesia:—

℞ Camphoræ, Betanaphthol	aa	65 Gm. or gr. x.
M. et adde:—		
Ol. anthemidis		30 c.cm. or *m*v.
Bismuth. subnit.	4	Gm. or ʒj.
Pulveris marantæ	4	Gm. or ʒj.
Ungt. zinci oxidi	31	Gm. or ℥j.—M.
℞ Camphoræ		65 Gm. or gr. x.
Sulphuris sublimati	2	Gm. or ʒss.
Ol. eucalypti		60 c.cm. or *m*x.
Creosoti		50 c.cm. or *m*viij.
Ungt. aquæ rosæ, Ungt. zinci oxidi	aa 15	5 Gm. or ℥ss.—M.

Camphor with salicylic acid (14 to 11) combines with the aid of heat, and, in the form of ointment, has been used in lupus and chronic ulcers. The odor of camphor is inhaled with some relief in coryza. Camphor cerate is a useful application for chapped hands and roughness of the skin, or the camphor can be incorporated in suet or lanolin:—

℞ Camphoræ ..... 2 | Gm. or 3ss.
Ol. neroli ..... | 18 c.cm. or *m*iij.
Phenolis liq. ..... | 24 c.cm. or *m*iv.
Sevi ..... 62 | Gm. or ℥ij.

M. Sig.: Rub a small piece in the palm of the hand until soft, and apply over the surface for chronic eczema; chapped hands; fissures on the lips, at the angle of the mouth, or around the nipples, anus, or genital organs.

℞ Camphoræ ..... 1 | 30 Gm. or gr. xx.
Ol. juniperi ..... 1 | 20 c.cm. or *m*xx.
Adipis lanæ hydrosi ..... 31 | Gm. or ℥j.

M. Sig.: Use in the diseases above named.

Internally, camphor is valuable as an anodyne, antispasmodic, and carminative, in disorders of the digestive organs attended with pain or cramps, and is generally combined with astringents and opiates. Velpeau's diarrhœa mixture consists of equal parts of spirit of camphor, tincture of opium, and compound tincture of gambir.

For diarrhœa Hope's camphor mixture is useful, especially in diarrhœa of relaxation in elderly subjects. Parrish's camphor mixture (mistura camphoræ aromatica, N. F.) is also valued:—

℞ Tr. lavandulæ co. ..... 120 | c.cm. or f℥iv.
Sacchari ..... 15 | 5 Gm. or ℥ss.
Aquæ camphoræ ..... 473 | c.cm. or f℥xvj.

M. Sig.: A tablespoonful every three hours for diarrhœa.

This remedy is likewise very serviceable in infantile diarrhœa. It has been found efficient in Asiatic cholera, provided it be given at the inception of the disease.

Camphor, in 0.13 Gm. (or gr. ij) pills, is serviceable in dysmenorrhœa, hysteria, and obscure nervous manifestations in women. It may likewise be given to relieve palpitation of the heart. Monobromated camphor is esteemed a valuable remedy in chordee and irritable bladder; it has also been used in spasmodic affections, hysteria, epilepsy, chorea, delirium tremens, whooping-cough, etc.

℞ Camphoræ ..... 1 | 30 Gm. or gr. xx.
Ætheris ..... q. s. ad ft. pulv.
Ammonii carbonat. ..... 1 | Gm. or gr. xvj.
Pulv. opii ..... | 25 Gm. or gr. iv.

M. et div. in chartulæ no. xij.
Sig.: Give one every two or three hours, in coryza.

In order to allay the mental excitement of hysteria, M. Blocq orders:—

℞ Camphor. monobrom. ..... 3 | Gm. or gr. xlv.
Ext. quassiæ ..... 2 | Gm. or 3ss.
Syrupi ..... q. s.

M. et ft. pil. no. xxx.
Sig.: One, two, or three pills a day.

It has likewise been successfully employed in spermatorrhœa. Dr. Bourneville has obtained excellent results from the administration of monobromated camphor in the treatment of epilepsy, accompanied by frequent attacks of vertigo. As a result of his studies, Dr. Bourneville concludes that in vertiginous epilepsy the administration of monobromated camphor alone is remedial, but in the typical paroxysmal variety it should be given together

with a combination of bromides. It is a curious fact that the addition of a few drops of camphor to a glass of water will, when injected into the rectum, produce a prompt evacuation of the bowels, thus offering a means of overcoming a tendency to constipation.

Camphor has at times been successfully employed in the management of mania, melancholia, and delirium tremens. A combination of camphor and opium relieves the after-pains of labor. The same drugs are advantageously given in the form of a suppository after operations upon the urethra, and in prostatorrhœa (enlarged prostate), cystitis, and, in fact, in all diseases of the genito-urinary organs, according to these formulæ:—

℞ Camphoræ,
Iodoform. vel aristol. vel iodol. . . . . aa 4| Gm. or 3j.
Ol. theobromatis . . . . . q. s.
M. et ft. suppos. no. xv.
Sig.: Insert one, when necessary, into the bowel.

℞ Camphoræ,
Lupulini . . . . . aa 4| Gm. or 3j.
Ext. belladonnæ folior. . . . . |16 Gm. or gr. iiss.
Ol. theobromatis . . . . . q. s.
M. et ft. suppositoria no. x.
Sig.: Insert one in the bowel every two or three hours.

As camphor escapes from the system largely by the bronchial mucous membrane, it is a useful remedy in chronic bronchitis, especially when occurring in the weak or aged, or associated with emphysema. Its stimulant virtues render it useful, also, in capillary bronchitis and typhoid pneumonia. This substance may be very serviceably administered in typhus or typhoid fever, or in the eruptive fevers, in order to strengthen the action of the heart. Professor Baelz,[1] of Tokio University, Japan, in fact, for five years has used camphor to the exclusion of all other medication, in typhoid fever, administering 1 Gm. (or gr. xv) daily. He considers it superior to any other drug that he has employed.

In influenza Dr. F. W. Devereux Long prescribes:—

℞ Spiritus camphoræ,
Tr. lavand. co. . . . . aa 7|5 c.cm. or f3ij.
Sp. chloroformi . . . . . 4| c.cm. or f3j.
Mucilag. tragacanth. . . . . 60| c.cm. or f℥ij.
Aquæ . . . . . q. s. ad 180| c.cm. or f℥vj.
M. Sig.: Two tablespoonfuls every fourth hour.

Liniment of camphor, or camphorated oil, is an excellent application to swollen and painful breasts during lactation. Injections subcutaneously of camphorated oil are said by Alexander to be of benefit in tuberculosis, acting as a tonic, strengthening the heart, and reducing fever. In laryngeal tuberculosis he applies it directly to the lesion. Obstinate hiccoughs were relieved by a hypodermic injection of camphorated oil, by James Tyson. Dr. L. Gaussia has made use of this combination in threatened heart-failure, in influenza, pneumonia, typhoid fever, and other debilitating diseases. This writer gave 2 to 4 c.cm. (or gtt. xxx-lx) daily of a 1-per-cent. to 5-per-cent. solution. B. Alexander [2] has for eleven years used, in the treatment of pul-

[1] *Journal of the American Medical Association*, p. 1238, vol. xxxiii, Nov. 11, 1899.
[2] *Münchener medicinische Wochenschrift*, Feb. 27, 1900.

monary tuberculosis, hypodermic injections of the camphorated oil of the German Pharmacopœia (11 to 9), with remarkable benefit. The injections are made once a day, 1 to 3 cg. (or gr. $^1/_6$-$^1/_2$) each, in febrile or afebrile cases, or 1 cg. (or gr. $^1/_6$) every day for four days and then suspended for eight. Improvement is noted after the second injection, even in advanced cases. Dr. Courtin reports good results in the treatment of tuberculous adenitis from injections of a mixture of 1 part each of betanaphthol and camphor and 4 parts of 60° alcohol.

Borneol is an artificial camphor obtained from oil of turpentine by treating it with hydrochloric acid. It is said to be identical in chemical composition, and to closely resemble, in its physical characters, the natural camphor. According to Stockman, it has the same effects upon the circulation, but shows a tendency to depress or paralyze the pneumogastric nerves, and induces palpitation of the heart.

Camphoric Acid is the product of the oxidation of camphor with nitric acid. It occurs in the form of fine, white, crystalline lamellæ, melts at 368.6° F., is slightly soluble in water, readily soluble in ethylic alcohol and ether. It is without odor, but has a somewhat acid and slightly astringent taste. In a healthy person it produces congestion of the face, neck, and conjunctivæ, with pain in the head. It checks the secretion of sweat, even in the normal man, but seems to have no influence upon the saliva or to cause dryness of the throat and skin. Camphoric acid is eliminated in the urine and preserves this fluid from undergoing putrefactive changes for several days. It may be given in doses of 0.50 to 4 Gm. (or gr. viii-lx). The ammoniacal urine of cystitis is speedily cleared and rendered acid by the administration of 1 Gm. (or gr. xv) three times a day. It is of avail, also, as a local remedy in chronic cystitis, the bladder being washed out twice daily with a $^1/_2$-per-cent. solution. A stronger solution than 1 per cent. is too irritant for use. The 1-per-cent. solution in water may be used in laryngological practice as a spray in catarrhal affections; it probably exerts some antiseptic as well as a sedative effect. The local application of a 2-per-cent. solution of camphoric acid is useful in acute coryza.

A 1-per-cent. solution is also a serviceable gargle in many forms of sore throat. Alone, or in combination with other remedies, such as boric acid or sodium borate, it is valuable in treating strangury and irritability of the bladder, and in the night-sweats of phthisis. The suppression of night-sweats is produced by daily doses of 2 Gm. (or gr. xxx), or more; certainly by single doses of 2 Gm. (or gr. xxx), according to the experiments of Combemale. Dr. Howard has also seen camphoric acid repress profuse perspiration in acute articular rheumatism. In a case of myoma of the uterus in which excessive nocturnal sweating had followed electrical treatment, Dr. Ralph Stockman, of Edinburgh, ordered 1 Gm. (or gr. xv) of camphoric acid at night, and after taking it for two weeks the tendency to sweating completely disappeared and never returned. The same author has used it in cases of hyperidrosis after influenza, and in other cases where there was certainly no tubercle present, and, in all of them, doses of 1 to 2 Gm. (or gr. xv-xxx) gave fairly satisfactory or good results. Dr. Stockman emphasizes its value in non-tubercular cases. He considers it as efficient as atropine, but in some obstinate cases it is less powerful as an anhydrotic than picrotoxin. Its toxicity is very slight. It may be used in spermatorrhœa

and in enuresis; and it has also been thought to have some influence over epilepsy, chorea, hysteria, and other spasmodic affections.

Oxycamphor.—By the action of hypochlorous acid upon camphor, and treating the product with an alcoholic solution of potassium hydroxide, **Oxycamphor** ($C_{10}H_{16}O_2$) is formed, which crystallizes in needles, has the odor and taste of camphor, and can be sublimed without change. It melts at 137° C. (or 278.6° F). Oxycamphor reduces the excitability of the respiratory centre, and has been used by Rumpel, of Hamburg, and others, in doses of 0.50 to 1 c.cm. (or *m*viij-xv); the maximum quantity in the day should not be more than 4 c.cm. (or ʒj). Oxycamphor in 50-per-cent. solution, in alcohol, is the most convenient for prescribing. This solution is known commercially also by the name (registered) of **Oxaphor.** Rumpel prescribes the drug in the following combination:—

℞ Spiritus oxycamphor (50 per cent.)	12	c.cm. or ʒiij.
Spiritus vini	6	c.cm. or ʒjss.
Fluidextractum glycyrrhizæ	3	c.cm. or *m*xlv.
Aquæ destillatæ q. s. ad	180	c.cm. or ʒvj.

M. Dose, a tablespoonful containing eight minims.

CANELLÆ CORTEX.—Canella-bark.

Dose, 0.60 to 2.60 Gm. (or gr. x-xl).

The bark of Canella Winterana (Canellaceæ), deprived of its corky layer and dried. This aromatic bark is sometimes called "white cinnamon." It contains a bitter extractive, **Eugenol,** and a volatile oil, but no tannin. As a carminative, it is used in hot infusion. For dysmenorrhœa, the powder of aloes and canella (N. F.), anciently known as hiera picra (aloes 8 parts, canella 2 parts), is given, in doses of 0.65 to 0.30 Gm. (or gr. x-xx).

CANNABIS INDICA (U. S. P., B. P.).—**Indian Cannabis, Indian Hemp.**

Preparations.

Fluidextractum Cannabis Indicæ (U. S. P.).—Fluid Extract of Indian Cannabis. Dose, 0.06 to 0.60 c.cm. (or *m*i-x).

Extractum Cannabis Indicæ (U. S. P., P. B.).—Extract of Indian Cannabis. Dose, 0.03 Gm. (or gr. ss). B. P., 0.015 to 0.065 Gm. (or gr. $^1/_4$-j).

Tinctura Cannabis Indicæ (U. S .P., B. P.).—Tincture of Indian Cannabis (10 per cent., U. S. P.; 5 per cent., B. P.). Dose, 0.12 to 0.50 c.cm. (or *m*ii-viij), U. S. P.; 0.30 to 1 c.cm. (or *m*v-xv), B. P.

Pharmacology.—Cannabis Indica officially is "the dried, prepared tops of the pistillate plants of Cannabis sativa (Urticaceæ), grown in the East Indies, and gathered while the fruits are still undeveloped and carrying the whole of their natural resin." Indian hemp should not be confounded with Asclepias incarnata, which is sometimes called white Indian hemp, or with Apocynum Cannabinum, Canadian hemp. A native confection made from hemp is called "hashish" or "gunjah"; an inferior kind is known as "bhang." The American and East-Indian plants are botanically the same, but the latter contains a larger quantity of the active principles, which are a resin, a volatile alkaloid **Cannabinine,** and a yellow, aromatic, volatile oil. From the latter may be obtained **Cannabene,** of which the hydride is a crystalline substance. The resin appears to be, or to contain, the active constituent of the drug. Wood, Spively, and Easterfield, in addition to several terpenes, isolated a substance from the resin for which they proposed the

name of **Cannabinol.** By oxidizing the resin with nitric acid, Bolas and France obtained a crystalline substance, oxy-cannabine[1] ($C_{20}H_{20}N_2O_7$). Cannabin tannate has been employed in medicine in doses of 0.065 to 0.65 Gm. (or gr. i-x), but it does not appear to have very active therapeutic powers. Churrus is the native name for the impure or crude resin. A watery extract (the Extractum Cannabis Indicæ Aquosum Fluidum), according to Dr. Cowan Lees, has a manifest anodyne and hypnotic effect, while free from the intoxication, bordering on poisoning, which follows the use of the alcoholic preparations. The dose for adults is from 2 to 4 c.cm. (or *m*xxx-lx). It is claimed by Dr. Lees to be especially valuable for the relief of cough in tuberculosis of the lungs and also as a soporific in diseases of children. Hashishin is an unofficial alcoholic extract washed with water, used in dyspepsia and gastric neuroses. (Dose, 0.04 Gm., or gr. $^3/_4$, per day).

Physiological Action. — Indian hemp has no local action. Upon the digestion and circulation no evident effect is produced. It acts like opium, in first stimulating the nervous system and afterward depressing the vital functions. The primary stage of intoxication is accompanied by exhilaration, which lasts for some time before sleep occurs. During this period the imagination is actively engaged, intent upon visions of its own creation, which at first are pleasant, but which after awhile may become terrifying. It is noticed, as one of the first manifestations of the toxic effect, that the ideas of space and time are disturbed and become exaggerated; there is often a curious sense of double consciousness. Numbness and tingling in the extremities are observed, followed by anæsthesia and diminution of muscular sense. Cannabis is antispasmodic, analgesic, hypnotic, and, in the East, is believed to be aphrodisiac. If a large dose be taken, coma or catalepsy may supervene, but a fatal effect rarely follows. The subsequent results from indulgence in this drug as an intoxicant are dullness and lassitude, vertigo and headache, and diuresis, but not constipation. Frequent use of the drug brings about mental deterioration and unfitness for labor. The abuse of Cannabis Indica is a prolific cause of insanity in Eastern countries. An irresistible impulse to kill is, according to Dr. Thomas Ireland, occasionally one of the characteristic symptoms of intoxication from this drug. Dr. C. R. Marshall reports an interesting personal experience in which the characteristic toxic symptoms were produced by a small dose of **Cannabinol,** 0.1 to 0.13 Gm. (or gr. iss-ij).[2] A case has been reported by Dr. J. Nevins Hyde in which, after a dose of 0.065 Gm. (or gr. j) of Cannabis Indica, a papular and vesicular eruption made its appearance upon nearly every part of the body, and gave rise to severe itching. Toxic symptoms have been manifested after taking two doses of 0.75 c.cm. (or *m*xij) of the English tincture, four hours apart, as in a case reported by Dr. Antony Roche.[3]

Therapy.—Owing largely to the uncertain quality of the drug, hemp is not employed to the extent that its physiological action would warrant.

Cannabis Indica has been found extremely useful in acute dementia due to mental anxiety, and also in melancholia. This agent also may be successfully prescribed in order to combat the wakefulness of delirium tremens, and good results have been ascribed to it in the management of

[1] Dr. C. R. Marshall, on "The Active Principle of Indian Hemp," *Lancet*, Jan. 23, 1897.

[2] *Lancet*. Jan. 23, 1897.

[3] *Lancet*, Dec. 24, 1898.

tetanus. It has been employed with advantage in chorea, and may sometimes be of avail in epilepsy. Amelioration has been produced by this remedy in senile trembling and paralysis agitans. In neuralgia and migraine good results follow its cautious use. In other painful affections, Cannabis Indica may be resorted to with advantage. Dr. Stephen Mackenzie has found cannabis of value in the severe headache of cerebral tumors, in chronic and persistent cephalalgia, and in the violent pains of locomotor ataxia. He has found it of service also in gastralgia and enteralgia. It may be administered to mitigate the suffering caused by the passage of an hepatic or renal calculus. In acute or chronic rheumatism, in gout, and in carcinoma hemp may often be very serviceably substituted for opium, over which it has the advantage that it does not derange the secretions.

Cannabis Indica quiets the delirium of cerebral softening. Dr. R. T. Edes, of Boston, has, in a number of instances, observed the use of this drug to banish the tendency to bad dreams. It allays the itching of eczema. In the itching which accompanies many cutaneous affections, and particularly in senile pruritus, the internal administration of Cannabis Indica will often afford relief. In various uterine disorders it is used to relieve pain and bring about contraction of uterine muscular fibre. The pain of dysmenorrhœa may not infrequently be controlled by Cannabis Indica. Its influence upon the muscular structure of the womb renders it valuable in menorrhagia. Its virtue is enhanced, in this affection, by combination with ergot. It has been found particularly useful in the abundant floodings which sometimes precede the menopause, and, in fact, it possesses considerable power as a general hæmostatic.

Cannabis Indica has also been used with advantage in uterine subinvolution and chronic endometritis. The headaches which attend the grand climacteric will sometimes yield to this remedy. In combination with nux vomica it is regarded by de Schweinitz as of value in headache dependent upon retinal asthenopia. It may be productive of good results in impotence unconnected with gross lesion. In spasm of the bladder and dysuria it gives relief, and also, in acute gonorrhœa with chordee, we see good effects from its exhibition. It can be given in either of these combinations with marked benefit for relieving the latter distressing symptom:—

℞ Fluidextracti cannabis Indicæ	2	c.cm. or f3ss.
Sodii bromidi	12	Gm. or 3iij.
Mist. sodæ menth.	90	c.cm. or f℥iij.
Syrup. aurantii	60	c.cm. or f℥ij.

Sig.: A tablespoonful at bed-time. Repeat every hour or two until relieved.

℞ Extracti cannabis Indicæ	20	Gm. or gr. iij.
Chlorali hydrati	4	Gm. or 3j.
Extracti opii	38	Gm. or gr. vj.
Ol. theobromatis	q. s.	

M. et ft. suppositoriæ no. xij.

Sig.: Insert one in the bowel on retiring, and every two or three hours when troubled with chordee.

By some practitioners it is esteemed of value in acute and chronic Bright's disease, the presence of hæmaturia especially indicating its employment. Trial has been made of the drug in diabetes mellitus. Though it may, at times, be able to moderate cerebral irritability, it exerts no marked influence upon the course or severity of the disease. The spasm of asthma

is sometimes very rapidly relieved by hemp. In whooping-cough, also, it may prove of service. It is a good remedy in irritable or reflex cough.

Mackenzie recommends the use of Cannabis Indica in hay fever and hay asthma. Germain Sée warmly recommends Cannabis Indica as a gastric sedative of particular value in functional disorders of the stomach and bowels attended with pain, acidity, and flatulence. He advises 0.04 Gm. (or gr. $^3/_4$) of the extract to be given in three doses, or it can be prescribed in the form of the fluid extract, and creosote added with great advantage:—

℞ Fluidextracti cannabis Indicæ	3	10 c.cm. or *m*ı.
Creosoti		30 c.cm. or *m*v.
Syrup. acaciæ	90	c.cm. or fʒiij.

M. Sig.: A teaspoonful before meals.

It is also of value in the treatment of gastric ulcer and may be combined with silver nitrate, the efficacy of which it increases. Cannabis Indica is said by Macconnell to be of value in diarrhœa dependent upon indigestion. Cannabis Indica is said to do good in exophthalmic goitre, and to cure, in some instances, the opium or chloral habit. The tannate of cannabin is a good hypnotic, and has been used for insomnia among the insane. The same property is shared by cannabin and cannabinone, both of which are given in doses of 0.03 to 0.13 Gm. (or gr. ss-ij). The oil of hemp-seed (oleum cannabis) is a drying, fixed oil expressed from the seeds; it is green in color, disagreeable to smell, and bland to the taste. It is used in the manufacture of a green soft-soap of deservedly high reputation in treating eczema and other skin diseases.

The tincture of Cannabis Americana is regarded by some as equal in value to copaiba or sandal-wood in the treatment of gonorrhœa. The preparation should be made from the fresh plant and be given in doses of 3 to 5 drops three or four times a day after subsidence of the acute symptoms.

CANTHARIS (U. S. P., B. P.).—Cantharides. (Spanish Flies.)

Preparations.

Collodium Cantharidatum (U. S. P.).—Cantharidal Collodion (60 per cent.).

Ceratum Cantharidis (U. S. P.).—Cantharides Cerate (cantharides, 32 Gm.; yellow wax and resin, aa 18 Gm.; lard, 22 Gm.; oil of turpentine, 15 c.cm.).

Emplastrum Picis Cantharidatum (U. S. P.).—Plaster of Pitch and Cantharides; Warming Plaster (Burgundy pitch, 92 Gm.; cerate of cantharides, 8 Gm.).

Tinctura Cantharidis (U. S. P., B. P.).—Tincture of Cantharides (10 per cent.). Dose, (U. S. P.), 0.06 to 0.60 c.cm. (or *m*i-x). (The British tincture is only $1^1/_4$ per cent.). Dose, 0.30 to 4 c.cm. (or *m*v-3j).

Acetum Cantharidis (B. P.).—Vinegar of Cantharides (10 per cent.).

Liquor Epispasticus (B. P.).—Blistering Liquid (50 per cent. with acetic ether).

Unguentum Cantharidis (B. P.).—Cantharides Ointment (cantharides, bruised, 1 Gm.; benzoated lard, 10 Gm.).

Emplastrum Cantharidis (B. P.).—Cantharides Plaster (35 per cent.).

Emplastrum Calefaciens (B. P.).—Warming Plaster.

Collodium Vesicans (B. P.).—Blistering Collodion (blistering liquid, 40 c.cm.; pyroxylin, 1 Gm.).

Pharmacology. — Cantharis vesicatoria (class, Insecta; order, Coleoptera), thoroughly dried, at a temperature not exceeding 104° F., occurs in pharmacy, either whole or in a more or less fragmentary condition, or as a brownish powder, in which the bright-green fragments of the elytra are very noticeable. The dust is very irritating, and the eyes should be protected when the drug is powdered in the mortar. The perfect flies are stronger

than the powder, which often has been damaged by the ravages of mites or lower forms of life. The active constituent is **Cantharidin**, the anhydride, or lactone, of cantharadinic acid (discovered by Robiquet in 1810) which is contained chiefly in the soft parts, and especially the generative apparatus, the blood, and in the eggs (Leidy). It is soluble in alcohol, ether, chloroform, etc. Besides this, which constitutes rather less than 1 per cent., there are a green oil, black matter soluble in water, a yellow viscid matter, fat, calcium and magnesium phosphates, acetic, formic, and uric acids, and a volatile principle upon which the fetid odor depends, and which, according to Dragendorff, acts upon the system like cantharidin. The green coloring matter appears to be identical with chlorophyl.

Physiological Action.—When applied to the skin, an active preparation of cantharides causes burning pain with hyperæmia, to which, in the course of a few hours, succeeds the formation of vesicles, exhibiting a tendency to run together and form a large bleb corresponding with the area of application. If the action is continued, sloughing and ulceration result. The engorgement of the capillaries in the superficial structures is associated with anæmia of the deeper structures. When applied to the chest, the lung underneath becomes pale and anæmic, and, if its action be too long continued, a blister may cause inflammation of the pleura; or it may produce peritonitis if applied to the abdomen. Slight elevation of temperature attends the action of the blister, which may be followed by depression of temperature and weakening of the heart's action. Constitutional effects may be caused by absorption of the active principles through the integument. When introduced into the stomach, cantharides is capable of setting up much irritation and even gastro-enteritis, with vomiting, or purging and tenesmus. The active principles soon pass into the blood, and at first slightly stimulate the heart's action; but the effect is most marked upon the genito-urinary organs, as the kidneys are the chief organs by which they are excreted. Extreme irritation of the bladder is produced, the urine is voided frequently, and, owing to the congested state of the kidneys, often contains albumin and blood. There may be suppression of urine. Associated with this is priapism, with pain in the glans penis, urethra, bladder, and aching in the renal region. Sloughing of the external genitals has been known to occur in consequence of the administration of cantharides. Toxic doses, according to Cautieri, cause a rapid diminution of blood-pressure, decreasing the force of the heart's action, but increasing the pulse-rate. In fatal cases inflammatory changes are found in the alimentary canal, with intense hyperæmia of the bladder and kidneys.

The vulgar notion that cantharides causes erotic sensations, or increased sexual power, has no foundation except in the evidences of congestion and inflammation of the urinary passages just referred to. The results of swallowing a few grains of Spanish flies may be quite serious, and it is regarded by the law as a penal offense to administer this drug surreptitiously and with evil intent. The treatment of poisoning by cantharides is by bland drinks and opiates and a hot bath. Bismuth and cocaine are also of service. Animal charcoal has also been recommended as an antidote. An anæsthetic may be necessary.

Therapy.—Blisters are usually spread with cerate of cantharides, or preferably with the cerate of the extract of cantharides, the prescription being as follows:—

℞ Cerati cantharidis, q. s.
Fiat emplastrum 2 × 3 in.
Sig.: Apply to designated spot and allow it to remain four hours. Then remove it and substitute a moist compress.

The skin overlying the effusion should not be removed, but simply punctured to allow the serum to escape; the spot is then dressed with some bland fat, such as suet or benzoinated lard. A good way to raise a blister is to use the blistering collodion and paint one or two coats over the desired area, and lay over it a piece of waxed paper, under which the blister raises in a few hours. Saint-Philippe has suggested that the danger of strangury may be lessened by the preliminary use of an alkaline diuretic until the urine has become alkaline. It is also a good plan to sprinkle a small quantity of morphine and camphor over the surface of the plaster before it is placed in position. Blisters are employed therapeutically to relieve pain, to reduce inflammation, and as revulsants to promote absorption of inflammatory products. The warming plaster is very useful in pleurodynia. Meningeal or pleural inflammation may be checked by the prompt application of a good-sized blister to the scalp or to the chest. In iritis, blisters behind the ears are often serviceable. Dr. C. Ziem recommends painting cantharidal collodion behind the ear, extending downward as far as the jaw, in the treatment of certain acute inflammatory affections of the eye. He makes use of the same method for relief in cases of abscess of the thyroid gland, and inflammation of the frontal sinus and antrum of Highmore. In pericarditis, marked relief may be afforded by blistering. A blister over the stomach will arrest obstinate vomiting; and gleet is sometimes cured by a blister to the perineum. Vesication of the back of the neck is said by Swan to be a useful measure in cases of incontinence of urine. Neuralgia is promptly relieved by a small blister to the painful point; and neuritis is cured by fly blisters; that is to say, a succession of small blisters along the course of the nerve. In acute rheumatism, marked relief is sometimes afforded to a swollen joint by surrounding it with small blisters. A blister over the affected joint is a good remedy in chronic synovitis. A large blister over the heart, applied early in the course of acute rheumatism, is often remarkably successful in reducing temperature and relieving pain; probably, also, it is of use in obviating the tendency to endocarditis, or curing it if present. In pleural effusion, absorption may be hastened in a similar manner, and also the clearing up of the lung after pneumonia. The warming plaster here may be worn for several days, if the skin is not too sensitive. Blisters must be used with caution in aged or debilitated patients; also in children. They should not be applied to parts deprived of vitality by paralysis, or to cicatricial tissue, or where the skin is poorly nourished. The possibility of absorption and serious results should be kept in mind. Nor should a blister be allowed to remain on too long. Cantharis should not be used as a vesicating agent in the case of patients whose kidneys are damaged. The cerate, or tincture, of cantharides enters sometimes into the composition of pomades or lotions for the treatment of alopecia circumscripta, and cantharidal collodion painted over the patches, every week or ten days, is at times efficacious.

In small doses, not exceeding 0.12 to 0.18 c.cm. (or *m*ii-iij) daily of the tincture, cantharides has been commended as a stimulant to the urinary organs, in hæmaturia, Bright's disease of the kidneys, pyelitis, cystitis, incontinence of urine, gleet, and leucorrhœa; but is contra-indicated in active

conditions of inflammation. Given in this manner, it is claimed to relieve chordee. Ringer recommends full doses of the tincture of cantharides, in combination with tincture of iron and phosphoric acid or nux vomica, in the impotence due to old age, sexual excess, or masturbation. Cantharis has been employed with success in amenorrhœa due to atonic conditions, and has suppressed passive seminal emissions of the same character. Cutaneous affections, especially psoriasis and other squamous diseases, are sometimes much benefited by similar small doses of the tincture. It has been used to produce abortion, and, in these small doses just mentioned, has emmenagogic properties. There is some evidence to show that the internal administration of tincture of cantharides may check the progress of cancer. Several cases have been reported in which the tumor remained stationary and the symptoms improved, or in which, many years after removal of the growths, there had been no recurrence. It was given in association with the wine of camphor.

Potassium cantharidate has been introduced by Professor Liebreich as a remedy in tuberculosis, especially of the larynx. It is given by hypodermic injection, in doses of 1 to 2 decimilligrammes (or gr. $^1/_{600}$-$^1/_{300}$). The injection excites a moderate degree of pain, but is not generally followed by pronounced febrile reaction. In cases of simple inflammation and tuberculous infiltration of the larynx, potassium cantharidate causes an exudation of serum, which is, however, quickly reabsorbed. Hoarseness diminishes and swallowing becomes less difficult. Tuberculous ulcers show a tendency to heal. In pulmonary tuberculosis it has been found without effect upon the fever, cough, expectoration, or physical signs. The treatment is apt to excite slight albuminuria and urobilinuria. Peterutti has reported three cases treated by him more than three years previously, according to this method, with, at the time, apparently unfavorable results. He subsequently found two of the cases completely cured and the third so much improved as to simulate a cure.

Benefit has sometimes resulted in cases of lupus and granular lids. The same method is said to have occasioned improvement in non-tubercular chronic laryngitis. Dr. Ch. Talamon states that, although he has witnessed no favorable effects of potassium cantharidate in tubercular cases, he has observed that the salt possesses a decided diuretic action, more especially in tuberculous patients. In order to avoid the pain to which these injections give rise, Dr. Hennig has employed **Cocaine Cantharidate** in tuberculosis and some other chronic affections, as ozæna, nasal and laryngeal syphilis, etc. He uses a solution of 3 to 6 parts of the remedy in 2000 parts of chloroform-water, and the quantity injected is equal to 1 to 5 decimilligrammes (or gr. $^1/_{600}$-$^1/_{120}$ of cantharidin. Cocaine cantharidate is rather a simple mixture than a chemical combination and occurs in the form of an amorphous, white powder, destitute of odor and having a saline and pungent taste. It dissolves with difficulty in cold water, but is readily soluble in hot water. It is insoluble in ether, alcohol, and benzin. Cantharis tincture, internally, has been made use of as a systemic stimulant in adynamic conditions.

CAOUTCHOUC (B. P.).—India Rubber.

Preparation.

Liquor Caoutchouc (B. P.).—Solution of India Rubber (India rubber, 50 Gm.; benzol and carbon bisulphide, of each, 500 c.cm.).

Pharmacology. — The prepared milk-juice of Hevea Brasiliensis, and probably other species; known in commerce as pure Para rubber. (See **Elastica.**)

CAPSICUM (U. S. P.).—**Capsicum (Cayenne Pepper, African Pepper).**

CAPSICI FRUCTUS (B. P.).—**Capsicum.**

Dose, 0.065 to 1.30 Gm. (or gr. i-xx).

Preparations.

Fluidextractum Capsici (U. S. P.).—Fluid Extract of Capsicum (alcoholic). Dose, 0.06 to 0.30 c.cm. (or *mi*-v).

Oleoresina Capsici (U. S. P.).—Oleoresin of Capsicum. Dose, 0.003 to 0.12 Gm. (or $m^{1}/_{20}$-ij).

Emplastrum Capsici (U. S. P.).—Capsicum Plaster (contains oleoresin).

Tinctura Capsici (U. S. P., B. P.).—Tincture of Capsicum. Dose, 0.30 to 1 c.cm. (or *m*v-xv). The United States preparation is 10 per cent. strength, and the British preparation is only 5 per cent.

Pilulæ Podophylli, Belladonnæ, et Capsici (U. S. P.).—Pills of Podophyllum, Belladonna, and Capsicum (resin of podophyllin, 1.6 Gm. [or gr. xxivss]; extract of belladonna-leaves, 0.8 Gm. [or gr. xij$^{1}/_{4}$]; capsicum, 3.2 Gm. [or gr. xlix]; sugar of milk, acacia, and glycerin, to make 100 pills). Dose, 1 pill.

Unguentum Capsici (B. P.).—Capsicum Ointment (bruised capsicum-fruit, 12 Gm.; spermaceti, 6 Gm.; olive-oil, 44 Gm.).

Pharmacology.—The dried, ripe fruit of Capsicum fastigiatum (Solanaceæ), deprived of its calyx (U. S. P.); the dried, ripe fruit of Capsicum minimum (B. P.), constitutes capsicum, or red pepper, which grows in the East Indies and on the coast of Guinea. Different varieties are cultivated all over the world for culinary and medicinal purposes. The Capsicum annuum is most common in this country, of which there are a number of varieties, having different-shaped pods or large berries, the latter being picked green and used for pickling with vinegar. The chief constituent of red pepper is a crystallizable, acrid substance, **Capsaicin** (Thresh); also a yellow oil, resin, and a volatile alkaloid which in its odor resembles coniine.

Physiological Action and Therapy.—Capsicum occasions irritation when applied to the skin, and may produce vesication; it acts as a counter-irritant in relieving pain in the structures beneath, especially in neuralgia, subacute gout, chronic gout, rheumatism, and bronchitis. In the mouth the taste is hot and pungent, causing free flow of saliva, and similarly increasing the flow of gastric juice, producing warmth in the stomach, expelling flatus, and giving increased appetite and digestive power. Overdoses of capsicum will give rise to subacute or chronic gastritis. Excessive amounts cause severe pain, vomiting, and purging.

Capsicum stimulates the action of the heart and increases the digestive functions. It promotes the excretion of urine and possesses an aphrodisiac influence. A prescription of much utility in debility of the sexual organs is:—

℞ Pulveris capsici,
Extracti cocæ ..... aa 4| Gm. or 3j.
M. et ft. pilulæ no. xxx.
Sig. Two pills three or four times a day.

Capsicum plaster may be used when mild counter-irritation is desired. The tincture of capsicum may be employed with advantage in chilblains

when the surface is unbroken. Dr. Rheims recommends that a strong tincture of capsicum-pods should be mixed with an equal quantity of mucilage of gum arabic. The mixture is brushed two or three times upon tissue-paper, which is then applied to the affected surface and quickly relieves the itching and pain. Discolored bruises and chronic rheumatic pains are likewise benefited by the same treatment. Sawyer suggests a tincture of capsicum made with official, pure ether in place of rectified spirit. He reports[1] that ether, by its action on the sebaceous secretion of the skin, is preferable to alcohol as a menstruum for drugs designed to produce a therapeutic effect on or through the skin. It has also the advantage that oil of turpentine or a bland oil is easily miscible with it, if requisite to add either. He states that a mixture of equal parts of ethereal tincture of capsicum, liquor ammoniæ, oleum terebinthinæ, and oleum lini forms an excellent rubefacient liniment. An infusion of capsicum pods applied upon a piece of lint is remarkably efficacious in acute torticollis.

The tincture of capsicum is an excellent application to the mucous membrane of the mouth and especially the gums. It enters into very many tooth-washes, the following, used by Garretson, being very serviceable:—

℞ Tinct. capsici	7.5	c.cm. or f℥ij.
Spiritus odorat., Alcoholis aa	60	c.cm. or f℥ij.
Tinct. quillajæ	45	c.cm. or f℥iss.
Tinct. gentianæ comp.	30	c.cm. or f℥j.
Acidi acetici diluti	15	c.cm. or f℥ss.
Phenolis liquefacti	12	c.cm. or *m*ij.—M.

Capsicum infusion is used as an application to scarlatinal sore throat, or diluted as a gargle in tonsillitis, pharyngitis, or may be used as a gargle, thus:—

℞ Tinct. capsici	4	c.cm. or f℥j.
Potassii chloratis	12	Gm. or ʒiij.
Glycerini	60	c.cm. or f℥ij.
Acidi hydrochlor. dil.	11	c.cm. or f℥iij.
Aquæ rosæ ad	360	c.cm. or f℥xij.

Capsicum may be used externally as a hair-lotion for promoting the capillary growth:—

℞ Tinct. capsici	15	c.cm. or f℥ss.
Tinct. Quillajæ	30	c.cm. or f℥j.
Glycerini	7.5	c.cm. or f℥ij.
Tinct. cantharidis	11	c.cm. or f℥iij.
Spiritus rosmarini	45	c.cm. or f℥iss.
Aquæ rosæ	240	c.cm. or f℥viij.

M. Sig.: Drop on the hair night and morning and brush the scalp well.

Capsicum is given internally after a debauch or in cases of drink-craving as a substitute for alcoholic drinks in extemporaneous infusion 31 Gm. to 1000 (or ℥i-Oij, f℥ij). Dose, 15 to 60 c.cm. (or f℥ss-ij). In chronic catarrh of the stomach of drunkards, the tincture of capsicum, in 0.60-c.cm. (or gtt. x) doses before meals, serves as an appetizer. The tincture of capsicum is a valuable stimulant in delirium tremens. It may very serviceably be administered in beef-tea, and supports the heart, allays restlessness, and promotes

[1] *London Lancet*, May 17, 1890.

sleep. Capsicum, in fact, possesses a slight narcotic power, and can be given thus with marked effect:—

℞ Tincturæ capsici	7	5	c.cm. or f3ij.
Sodii bromidi	12		Gm. or 3iij.
Elix. lupulini	120		c.cm. or f3iv.

M. Sig.: Two teaspoonfuls in water every hour or two.

It is an excellent remedy in flatulent dyspepsia:—

℞ Pulveris capsici	2	40	Gm. or gr. xl.
Extracti nucis vomicæ		20	Gm. or gr. iij.
Extracti pancreatis	4		Gm. or 3j.

M. et ft. capsulæ no. xx.

Sig.: A capsule after meals.

Capsicum is beneficial in typhoid fever and typhoid conditions, as a stimulant. It acts also as a useful adjuvant in the treatment of malaria. As this substance invigorates the muscular coat of the arteries, it may be advantageously employed in order to control hæmorrhage from the lungs or the womb. On account of its irritant effects, it is contra-indicated in acute inflammation of the stomach or bowels. As excretion takes place by the kidneys, capsicum should be prohibited in inflammatory conditions of the genito-urinary tract; but in chronic disorders it may often be employed with advantage. In chronic nephritis, pyelitis, cystitis, and prostatorrhœa it frequently proves decidedly beneficial.

CARBO ANIMALIS (U. S. P.).—**Animal Charcoal.** (Charcoal prepared from bone.)

Dose, 16 Gm. (or ℥ss) in poisoning by alkaloids (for each grain).

CARBO LIGNI (U. S. P., B. P.).—**Charcoal.** (Charcoal prepared from soft wood and very finely powdered.)

Dose, 0.65 to 2 Gm. (or gr. x-xxx), or more. B. P., 4 to 8 Gm. (or 3i-ij).

Preparation.

Carbo Animalis Purificatus (U. S. P.).—Purified Animal Charcoal. Dose, 0.65 to 4 Gm. (or gr. x-3j).

Pharmacology.—Animal charcoal is prepared from bone by exposure to heat; and wood charcoal is obtained by a similar process from soft wood. The former occurs as a black powder or mass, the latter in large fragments preserving the shape of the billets of wood, or as a fine light powder. Purified animal charcoal is the charred bone after treatment with hydrochloric acid, which removes the earthy salts and leaves only the carbon. Recently-burned charcoal readily absorbs gases. It is an excellent deodorizer, and it destroys organic impurities by oxidation, decolorizing solutions containing them and rendering them inoffensive to taste or smell, but it is not, properly speaking, an antiseptic. It is a useful filtering agent, when fresh, for purifying water. Internally, it is given in too small doses to exert much effect of this kind in the intestinal tract, but it aids in purifying the stomach, partly by mechanical action. It increases secretion and peristalsis. Robert B. Wild,[1] in a prize essay on "Charcoal as a Therapeutic Agent," says we

[1] *New York Medical Journal*, April 4, 1896.

have in charcoal, whether dry or mixed with water, a powerful oxidizing agent, and one which, being non-poisonous, can be administered in large doses.

Therapy.—Charcoal is a good dressing to old or offensive gangrenous ulcers, as it absorbs the foul material and cleans the wound. It is generally utilized in the form of the charcoal poultice, being beaten up with bread-crumb or flaxseedmeal; or a small bag filled with powdered charcoal may be laid upon the poultice when it has been placed in position. It is sometimes used for tooth-powder, but it is open to the objection of scratching the teeth and discoloring the gums. Charcoal filters are useful in pharmacy, but not in the household, because, if not renewed daily, they lose their virtues, and only act as a breeding-place for germs of putrefaction and disease. Charcoal in powder or animal charcoal may be administered in cases of poisoning by organic poisons. In flatulent dyspepsia recently-burned charcoal is sometimes beneficial. It has been used to relieve the pain of gastric ulcer and gastralgia. In France it is sometimes prescribed as *magnesia noire*, and in England the term "black magnesia" is sometimes applied to powdered charcoal.

CARBONEI DISULPHIDUM (U. S. P.).—**Carbon Disulphide** (CS_2).

CARBONIS BISULPHIDUM (B. P.).—**Carbon Bisulphide.**

Pharmacology and Therapy.—Carbon disulphide is a clear, very diffusive inflammable liquid, of strong, offensive odor. It is a highly-refractive fluid, has a sharp, distinctive taste and a neutral reaction. It is highly poisonous, and its odor is also an objection to its internal use. It gives rise to severe headache and marked nervous excitement. Frequent exposure to its fumes occasions anæmia, physical and mental debility with, in some instances, amblyopia and epileptiform convulsions. Workers in rubber factories are liable to be affected by inhalation of carbon disulphide. The symptoms noted by Stadelmann[1] consisted of digestive disturbances, muscular weakness, tremor, ataxia, increased muscular irritability, painful muscular spasm, disturbed sensation; altered knee-jerk, sometimes increased, sometimes diminished, etc. These symptoms are not uncommon in Germany. Bernhardt states that the poison may affect the peripheral nerves and even give rise to a degenerative neuritis or paralysis. Hysterical symptoms have been observed. Stadelmann found no changes in the optic disk. Poisoning by this agent is treated by means of bromide and chloral, with the addition of stimulants if the circulation is depressed, although it is a valuable antiseptic, and has been used in typhoid fever, dyspepsia, and in gastric cancer. It has some anæsthetic and anodyne properties when inhaled. Locally, the vapor has been proposed to be applied for glandular enlargements and in defective secretion of cerumen in the ear. Local anæsthesia may be produced by the spray in neuralgia, etc. W. S. Cline claims that 15 c.cm. (or f℥ss) of the disulphide of carbon, being well rubbed over the painful parts, will cure sciatica.

Rubber stoppers should not be used for bottles containing this substance, and these should be kept away from flame and in a cool place.

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[1] *Berliner klinische Wochenschrift*, June 13, 1896.

CARDAMOMUM (U. S. P.).—**Cardamom.**

CARDAMOMI SEMINA (B. P.).—**Cardamom-seeds.**
Dose, 0.32 to 1 Gm. (or gr. v-xv).

Preparations.

Tinctura Cardamomi (U. S. P.).—Tincture of Cardamom (10 per cent.). Dose, 4 to 7.5 c.cm. (or f3i-ij).

Tinctura Cardamomi Composita (U. S. P., B. P.).—Compound Tincture of Cardamom (U. S. P. contains cardamom, 2; cinnamon, 2; caraway, 1; cochineal, $^1/_2$; glycerin, 5; in dilute alcohol, q. s. ad 100 parts). Dose, 4 to 15 c.cm. (or f3i-iv). B. P., 2 to 4 c.cm. (or f3ss-j).

Pulvis Aromaticus.—Aromatic Powder (U. S. P.); consists of cardamon and nutmeg, aa 15 Gm.; cinnamon and ginger, aa 35 Gm.

Pharmacology.—Cardamom is the dried, nearly-ripe fruit of Elettaria repens (Zingiberaceæ) (U. S. P.); the dried, ripe seeds of Elettaria Cardamomum (B. P.). It comes from Malabar, although other sources are recognized in commerce. The seeds are inclosed in capsules, the latter being valueless except as a protection for the former, which contain a volatile oil holding a camphoraceous substance in solution.

Therapy.—The seeds of cardamom are sometimes chewed and swallowed to relieve flatulence, or the tincture or compound tincture may be used, the latter being a valuable carminative combination. Where alcohol is objectionable, the aromatic powder may be substituted for the compound tincture in the treatment of atonic dyspepsia and flatulence, or an infusion may be used (30 Gm. to 240 c.cm. [or ℥j to f℥viij]).

CARDUUS BENEDICTUS.—Blessed Thistle. This plant belongs to the Compositæ and is a native of Asia and Europe. The leaves, sometimes the flowering tops, are used in decoction (1 to 8), and a fluid extract and solid extract have also been used. A bitter neutral principle, **Cnicin,**—crystallizing in colorless prisms, soluble in alcohol, less so in water,—appears to be the principal constituent; potassium nitrate is also present.

Therapy.—Carduus is a bitter tonic used in Germany in digestive weakness and chronic hepatic complaints; best given as the fluid extract (1 to 4 c.cm., or *m*xv-f℥j, at a dose), in which the menstruum is diluted alcohol. Cnicin has been given in doses of 0.32 to 0.65 Gm. (or gr. v-x) in intermittent fever, but in these quantities it is apt to cause nausea, vomiting, and diarrhœa. The **Carduus Marianus,** or St. Mary's Thistle, another variety, is used for the same purpose, but it is especially in repute for treating cases of gallstones. It has also been extolled as an hæmostatic, laxative, and diuretic (Lobach).

CAROTA.—Carrot-fruit. The seeds of Daucus carota (Umbelliferæ), of a grayish color, about $^1/_8$ inch in length, contain a volatile oil of aromatic odor and taste. Used in powder as a carminative and diuretic.

CARTHAMUS.—Safflower. The dried florets of Carthamus tinctorius (Compositæ). This plant contains a yellow coloring-matter, **Safflor-yellow;** a red coloring-matter, and carthamim, or carthaminic, acid. The latter is a red-brown powder, which, when mixed with chalk, forms "rouge." Inter-

nally, this agent is slightly stimulant and laxative. Hot infusions are diaphoretic, and are popularly given to expedite eruptions in exanthematous diseases (8 to 16 Gm. in 480 c.cm. of boiling water, given in doses of a wine-glassful).

CARUM (U. S. P.).—**Caraway.**

CARUI FRUCTUS (B. P.).—**Caraway-fruit.**
Dose, 0.65 to 2 Gm. (or gr. x-xxx).

Preparations.

Oleum Cari (U. S. P.).—Oil of Caraway. Dose, 0.06 to 0.30 c.cm. (or *m*i-v).
Oleum Carui (B. P.).—Oil of Caraway. Dose, 0.03 to 0.18 c.cm. (or *m*ss-iij).
Aqua Carui (B. P.).—Caraway-water (50 Gm. to 1000 c.cm. distilled to 500 c.cm.).
Caraway enters in the compound spirit of juniper (U. S. P.), the compound tincture of cardamom (U. S. P., B. P.), and spirit of juniper (B. P.).

Pharmacology and Therapy.—The dried, nearly ripe fruit of Carum carvi (Umbelliferæ) contains a volatile oil, and is prized as a condiment. It is used as a stimulant in flatulence, or in combination to prevent griping of other medicines. A case has been reported in which 4 c.cm. (or f℥j) of the oil of caraway produced cerebral congestion, delirium, and rigors in a man. Caraway has been thought to possess galactagogic properties.

CARYOPHYLLUS (U. S. P.), **CARYOPHYLLUM** (B. P.).—**Cloves.**

EUGENOL (U. S. P.).—**Eugenol.**
Dose, 0.20 c.cm. (or *m*iij).

Preparations.

Oleum Caryophylli (U. S. P., B. P.).—Oil of Cloves. Dose, 0.06 to 0.37 c.cm. (or *m*i-vj).
Infusum Caryophylli (B. P.).—Infusion of Cloves (2½ per cent.). Dose, 15 to 30 c.cm. (or f℥ss-j).
Also enters into the U. S. P. preparations of compound tincture of lavender, aromatic tincture of rhubarb, aromatic syrup of rhubarb, and wine of opium.

Pharmacology. — Cloves are the unexpanded flowers of Eugenia aromatica (Myrtaceæ), U. S. P.; the dried flower-buds of Eugenia caryophyllata (B. P.): a large tree of the Spice Islands and Africa. They are dark brown in color, about half an inch long, and have a strong, spicy odor and pungent, aromatic taste, owing to the presence of a heavy volatile oil (15 to 20 per cent.). They also contain **Eugenin,** tasteless crystalline substance; tannic acid; and a neutral, tasteless, odorless body, **Caryophyllin,** which crystallizes in needles. **Eugenol,** called also eugenic acid, constitutes four-fifths of the bulk of oil of cloves, is an unsaturated, aromatic phenol, very soluble in alcohol and but slightly soluble in water. It is also obtained from pimento, cinnamon, camphor, sassafras, and other similar volatile oils. Clove-stalks are the flower-stalks of the cloves; mother-cloves are the whole fruit.

Physiological Action. — Cloves are stimulant, carminative, and antiseptic. The oil has some anæsthetic influence over painful areas. In overdoses it will cause gastro-enteritis, has a soporific effect, and occasions death from respiratory failure. The oil of cloves is eliminated by the kidneys, liver, bronchial mucous membrane, and skin. It possesses antiseptic virtues.

Therapy.—The oil of cloves is used to destroy sensation in the nerve of hollow, aching teeth, and quickly relieves pain. In combination with lanolin, it may be used for eczema. The infusion is used internally as a stomachic tonic for the relief of flatulence and pain, but it is generally given in combination with other remedies. Fractional doses, 0.03 or 0.06 c.cm. (or gtt. ss or j) of the oil of cloves, given in a little water, will rapidly allay excessive vomiting. Dentists sometimes use oil of cloves, mixed into a paste with thymol iodide, in carious teeth, as a root-filling.

The growth of tubercle bacilli is retarded by tincture of cloves, and Mannotti, in eighteen cases of local tuberculosis, obtained marked improvement from injections of a 10-per-cent. emulsion of cloves in olive-oil. In lupus vulgaris the repeated application of oil of cloves is said to cause separation of the epithelium and retrocession of the nodules.

The oil of cloves is a parasiticide and has been made use of as an application in pediculosis. **Eugenol**, a constituent of the oil of cloves, has been combined, by a patented process, to form a compound termed benzoyl-eugenol, or benz-eugenol. This product, it is thought, may prove useful in the treatment of tuberculosis.

The acetamide of eugenol, a crystalline substance, is an active antiseptic and is also an excellent local anæsthetic. This compound may be advantageously employed in dentistry and minor surgery. It is prepared by acting upon the sodium salt of eugenol with monochloracetic acid, adding alcohol and chlorine-gas and treating with a strong solution of ammonia. Another combination which has been introduced is cinnamyl-eugenol, a colorless, crystalline substance, destitute of odor and taste, soluble in hot alcohol, ether, and chloroform. This compound has been applied to the treatment of tuberculosis.

CASCA CORTEX.—Sassy-bark.

Pharmacology.—The Erythrophlœum Guineense (Leguminosæ) is a large tree growing on the coast of Africa, which furnishes the ordeal-bark of Angola; otherwise casca, or sassy-bark. It contains an alkaloid, **Erythrophlœine.** A tincture (10 per cent.) has been used by Brunton, in doses of 0.30 to 0.60 c.cm. (or *m*v-x).

Physiological Action.—The powder causes sneezing when inhaled. The infusion or tincture gives rise to vomiting, purging, and intoxication, followed by death during convulsions. Upon the circulation erythrophlœum has an action like digitalis. Wilcox, of New York, found that in its action upon the vaso-motor system, it resembles digitalis and ergot combined.

Therapy.—In its native country sassy-bark is employed in the treatment of intermittent fever, flatulent dyspepsia, diarrhœa, and dysentery. Brunton finds the tincture useful in dilated heart without valvular disease; also in mitral disease and dropsy. The indications for its use are a rapid, low-tension pulse with venous congestion.

According to Prof. Germain Sée, sassy-bark is very useful in dyspnœa, markedly increasing the depth of inspiration. It disturbs the digestion more than digitalis. The hydrochloride of erythrophlœine is a salt in the form of a powder, soluble in water, which can be administered hypodermically in doses of 0.001 to 0.005 Gm. (or gr. $^1/_{60}$-$^1/_{12}$) as a local analgesic, but it is inferior to cocaine for this purpose.

CASCARA AMARGA.—Honduras Bark.

Pharmacology and Therapy.—The Cascara amarga (Simarubaceæ), or Honduras bark, has some reputation as a tonic and alterative. The fluid extract (dose, 2 to 4 c.cm., or f℥ss-j, several times a day) may be used in syphilis, chronic liver disease, nasal catarrh, and skin diseases (eczema, psoriasis, syphilodermata, etc.).

CASCARA SAGRADA (B. P.).—**Cascara Sagrada.** (See **Rhamnus Purshiana.**)

CASCARILLA (B. P.).—**Cascarilla Bark.**

Dose, 0.13 to 1.30 Gm. (or gr. ii-xx).

Preparations.

Infusum Cascarillæ (B. P.).—Infusion of Cascarilla (5 per cent.). Dose, 15 to 30 c.cm. (or f℥ss-j).

Tinctura Cascarilla (B. P.).—Tincture of Cascarilla (20 per cent.). Dose, 2 to 4 c.cm. (or f℥ss-j).

Pharmacology.—The dried bark of Croton eluteria (Euphorbiaceæ) from the Bahama Islands. It has a warm, rather bitter taste, and emits a fragrant odor when burned. **Cascarillin** is a bitter neutral substance, with volatile oil, resin, and tannin as the principal constituents. There are no official preparations, but the fluid extract, infusion, and tincture are used, none of which is miscible in water.

Therapy.—Cascarilla is a light tonic, somewhat stimulant and carminative, and the infusion has been used in low fevers. It may be profitably employed as a tonic in convalescence from typhoid fever or other exhausting disease.

CASSIA FISTULA (U. S. P.).—**Purging Cassia.**

CASSIA PULPA (B. P.).—**Cassia-pulp.**

Dose, 4 Gm. (or ℥j).

Pharmacology.—The dried, ripe fruit of Cassia fistula (Leguminosæ), a tree of the West Indies, is in cylindrical pods of a dark-brown color, containing from twenty-five to one hundred seeds in separate cells, and a dark-brown, soft, sweetish pulp, having an odor like prunes and containing about 60 per cent. of sugar. Good cassia yields about 30 per cent. of the pulp, which is the medicinal part of the drug. This is laxative in its action in doses of a drachm or more. There are no official preparations of cassia, but the confection of senna contains 16 per cent. Cassia fistula promotes the secretion of bile and communicates a brownish or greenish tint to the urine.

CASTANEA.—Chestnut.

Preparation.

Fluidextractum Castaneæ.—Fluid Extract of Chestnut. Dose, 4 to 7.5 c.cm. (or f℥i-ij).

Pharmacology and Therapy.—The dried leaves of Castanea dentata (Fagaceæ), collected in September or October, while they are yet green. They contain tannin, gallic acid, salts, and gum. A recent infusion has

been employed with alleged success in whooping-cough, and might, on account of its astringency, be used for diarrhœa of relaxation. For the latter purpose the fluid extract, of which the dose is 1 to 4 c.cm. (or f3 $^{1}/_{4}$ to j), is preferable.

CASTOREUM.—**Castor** is the dried preputial follicles, with their secretion, of the Castor fiber, or beaver, and freed from the small oil-sacks, associated anatomically with them. It is of unctuous consistency, a brown or reddish-brown color; a pungent, disagreeable smell; and a bitter, nauseous taste. It is soluble in alcohol and ether. Castor contains a volatile oil, a peculiar principle, of crystalline structure, termed **Castorin,** and salicylic aldehyde, together with other organic and inorganic constituents.

Therapy.—This substance has a certain stimulant effect upon the nervous system, and acts as an antispasmodic. It has been given in doses of 0.32 to 1.30 Gm. (or gr. v-xx) to control the spasms of hysteria and other convulsions, the tremors of typhoid fever, and those dependent upon an adynamic condition. It may be given with advantage in tympanites. Castor is supposed to possess emmenagogue properties, and has been administered in amenorrhœa and uterine colic. It is best given as the ethereal tincture (of the National Formulary), in doses of 4 to 12 c.cm. (or f3i-iij).

CATAPLASMA KAOLINI (U. S. P.).—**Cataplasm of Kaolin.** This new introduction into the pharmacopœia consists of kaolin, in No. 80 powder, 577 Gm., with boric acid, thymol, oils of gaultheria and peppermint, and glycerin, 375 Gm. It forms a smooth, light-gray paste, resembling soft putty in consistence. It is of agreeable odor and appearance.

When used, it should be spread on the skin as hot as it can be borne, or applied on strips of bandage.

This agent is hygroscopic, antiseptic, and resolvent. It is of great advantage in local inflammations, in cellulitis, sprains, boils, and also in internal inflammations, such as pleurisy, pneumonia, bronchitis, peritonitis, synovitis, mastitis, and orchitis. After being applied to the surface, absorbent cotton may be laid upon it, and a roller-bandage applied.

CATECHU (B. P.), or **GAMBIR** (U. S. P.).—**Gambir, or Pale Catechu. Dose,** 0.065 to 2 Gm. (or gr. i-xxx). B. P., 0.32 to 1 Gm. (or gr. v-xv).

Preparations.

Tinctura Gambir Composita (U. S. P.)—Compound Tincture of Gambir (gambir 5 per cent., and cinnamon 2$^{1}/_{2}$ per cent., in diluted alcohol). Dose, 2 to 8 c.cm. (or 3ss-ij).

Trochisci Gambir (U. S. P.), Catechu (B. P.).—Troches of Catechu (0.065 Gm., or gr. j. each). Dose, 1 or more.

Pulvis Catechu Compositus (B. P.).—Compound Powder of Catechu (catechu, 100; kino, 50; krameria, 50; cinnamon, 25; nutmeg, 25). Dose, 0.65 to 2.60 Gm. (or gr. x-xl).

Tinctura Catechu (B. P.).—Tincture of Catechu (20 per cent.; cinnamon, 5 per cent.). Dose, 2 to 4 c.cm. (or f3ss-j).

Pharmacology.—Gambir is an extract prepared from the leaves and twigs of Ourouparia Gambir (Rubiaceæ), United States Pharmacopœia; an extract of the leaves and young shoots of Uncaria Gambir, British Pharmacopœia: a large tree of Pegu. It is in large masses, hard and brittle,

glossy and porous on fracture; taste strongly astringent and sweetish; very little odor. The constituents of gambir extract, or cutch, are **Catechu-tannic Acid** and **Pyrocatechin**, or **Catechol**, the latter being insoluble in water; but the extract is entirely soluble in alcohol, though insoluble in ether. It is used also as a dye-stuff, as "cutch-brown."

Therapy.—Gambir is a valuable astringent. It may be used as a mouth-wash for spongy gums, a gargle in pharyngitis, or as an injection in gonorrhœa or leucorrhœa; but is most frequently employed in diarrhœas of relaxation.

As the yield of gambir has become insufficient to supply the demand, the Colonial Ministry of France has entered upon the cultivation, in Cochin China, of a tree, the **Brugniera gymnorhiza** (a variety of mangrove used as a dyestuff), the bark of which yields an extract which has been found to answer all the purposes of catechu.[1]

CATHA.—African Tea. A small shrub of Northwestern Africa, used by the natives as a stimulant and temporary substitute for food. Forskall gave it the name of Catha edulis (Celastraceæ). The leaves are chewed like those of the Erythroxylon coca, and are invigorating and restorative; the recent infusion acts like that of tea, maté, or coffee. The plant has been analyzed without detecting caffeine. Flückiger has isolated a liquid alkaloid, **Katrine.** An alkaloid, which seems to be the active principle, has been obtained by Prof. Ugolino Mosso, of Genoa.[2] To this substance the discoverer has given the name of **Celastrine.** It is present in the plant in such small quantities that its exact chemical composition has not yet been determined, but it is probably related to caffeine. During a primary stage and in small doses, celastrine is stimulant to the nervous system of frogs; during a secondary stage, and in large doses it is depressant. It produces an excitant effect upon the heart of the same animal. In dogs and rabbits blood-pressure and respiration were not notably influenced, but the activity of the sympathetic nerve was modified. In his experiments Professor Mosso found celastrine fatal in amounts in which cocaine is merely excitant. In intoxication from celastrine, sensibility is preserved to the last, and convulsions are lacking. The stimulant effect of celastrine is essentially manifested upon the brain, without leaving a trace of depression or visible disturbance of function. The spinal cord, vagi nerves, and heart may share the stimulant effect, but are less powerfully affected.

In medicine, catha might be useful as an arterial and nervous stimulant like coca, and probably would afford a cheap substitute at the table for the expensive tea so largely used, if once introduced in this country.

CAULOPHYLLUM.—Caulophyllum, Blue Cohosh.
Dose, 1 to 2.60 Gm. (or gr. xv-xl).

Preparation.

Fluidextractum Caulophylli.—Fluid Extract of Caulophyllum. Dose, 1 to 2.50 c.cm. (or *m*xv-x).

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[1] *Swiss Journal of Chemistry and Pharmacy*, 1899, p. 313; *American Journal of Pharmacy*, 1900, p. 178.

[2] See *Medical Bulletin*, Aug., 1891.

Pharmacology.—The dried rhizome and roots of Caulophyllum thalictroides (Berberidaceæ), or squaw-root, a plant indigenous to this country. It contains a saponin-like glucoside, **Leontine**, and two resins. It also contains a small proportion of a feeble alkaloid, known as **Caulophyllin.**

Therapy.—Caulophyllum is emmenagogue, parturifacient, and diuretic. It has some reputation in the treatment of rheumatism. It probably has some value as an expectorant, owing to the presence of **Leontine**, which is analogous to senegin found in Polygala senega, and might be valuable in bronchitis and catarrhal pneumonia.

CEDRON.—Cedron-seed. The Simaba cedron and S. ferruginea (Simarubaceæ), small trees of South America, contain two bitter principles: **Cedrine** and **Cedronine.** The seeds are also known as "rattlesnake-beans."

Therapy.—Cedron-seed has a reputation in South America for curing malarial affections, and is largely used in derangements of the digestive organs, diarrhœa, cholera morbus, etc. It is also claimed to have decided influence over the course of hydrophobia, and is said to be of value in treating poisoned wounds, bites of venomous snakes, insects, etc. The remedy is used both topically and internally, the usual dose being 0.065 to 0.13 Gm. (or gr. i-ij); but Dr. Purple gave it in doses of 1.30 to 2 Gm. (or gr. xx-xxx) every four hours, in intermittent fever, with satisfactory results.

CERA.—Wax.

Preparations.

Cera Alba (U. S. P., B. P.).—White Wax (yellow wax, bleached).
Cera Flava (U. S. P., B. P.).—Yellow Wax.
Ceratum (U. S. P.).—Cerate (white wax, 30; petrolatum, 20; lard, 50).
Also enters into cerates of camphor, cantharides, spermaceti, resin, and compound resin.

Pharmacology and Therapy.—Yellow wax is a solid substance, prepared from the honeycomb of the bee, Apis mellifica (Hymenoptera). It is insoluble in water and cold alcohol, but soluble in boiling alcohol, ether, chloroform, and oils. It is a soft solid, liquefying a little above the body-temperature, and is unirritating, except mechanically, to the skin and mucous membranes. White wax is yellow wax, bleached. It is largely used to give consistency to ointments and suppositories.

Epidermin.—This name has been given to a new ointment base, prepared by S. Kohn by melting 15.5 Gm. (or ℥ss) of white wax and triturating it in a warm mortar with an equal quantity of powdered gum arabic until an homogeneous paste is produced. To this mass is then added a boiling mixture of 15 c.cm. (or f℥ss) each of water and glycerin, and the whole is stirred together until cold. The result is a semifluid, creamy substance which, when applied to the surface in a thin layer, forms an adherent and flexible coating. Drugs which are to be incorporated with epidermin should be previously rubbed up with glycerin.

Cearin is a white, rather soft ointment-base, consisting of 1 part of Carnauba wax and 4 parts of liquid parraffin. According to Issleib, it is chemically unchangeable, ointments of potassium iodide (without sodium hyposulphite) and of red mercuric oxide remaining unaltered for eight months. It will take up about 15 per cent. of water.

CERII OXALAS (U. S. P., B. P.).—**Cerium Oxalate** ($Ce_2[C_2O_4]_3 + 9H_2O$).

Dose, 0.065 to 0.65 Gm. (or gr. i-x).

Pharmacology.—Cerium oxalate consists chiefly of a mixture of cerium, didymium, praseodymium, and lanthanum oxalates, and other rare earths of this group (U. S. P.). It is a white, granular powder, odorless and tasteless, insoluble in water or alcohol.

Therapy.—Sir J. Y. Simpson brought forward this remedy as one of great value in treating the vomiting of pregnancy, in which it is sometimes successful, but often fails. It is useful in controlling excessive cough in phthisis or chronic bronchitis, and in nervous disorders, chorea, epilepsy, and dysmenorrhœa. This salt occasionally proves useful in vomiting depending upon uterine disease, or even in cancer of the stomach. Cerium oxalate has been successfully employed to relieve obstinate vomiting occurring during the course of typhoid fever and phthisis. Dr. Busey prescribed it for the purpose of relieving nausea and headache produced by opium. It is a sedative to the gastric mucous membrane, and may allay the pain of gastralgia. It is beneficial in dyspepsia occasioned by depressed or deranged innervation of the stomach. The following prescriptions, containing cerium oxalate, have been employed with benefit:—

℞ Cerii oxalatis	6		Gm. or 3iss.
Bismuth. subnit.	10		Gm. or 3iiss.
Spiritus chloroformi	7	5	c.cm. or f3ij.
Liquor calcis,			
Syrup. acaciæ	aa 60		c.cm. or f℥ij.

M. Sig.: Two teaspoonfuls in water when necessary for nausea and diarrhœa.

℞ Cerii oxalatis	2	60	Gm. or gr. xl.
Ext. hyoscyami		20	Gm. or gr. iij.
Ext. conii		38	Gm. or gr. vj.
Ext. gentianæ		13	Gm. or gr. ij.

M. et ft. pil. no. xij.
Sig.: A pill every four hours for nausea and vomiting, especially of pregnancy.

Cerium oxalate is also occasionally efficacious in chronic diarrhœa. It is known to be contaminated with other metals, such as arsenic, lanthanum, etc., to which some of its therapeutic effects have been attributed.

If the remedy be pure, it may be given in doses of 0.65 Gm. (or gr. x) every four hours. Failure from its use has been ascribed to the smallness of the dose which is generally prescribed. Cerium nitrate was also employed by Simpson, who regarded it as useful in irritable dyspepsia with gastrodynia and pyrosis, as well as in chronic vomiting. The dose is the same as that of the oxalate.

CETACEUM (U. S. P., B. P.).—Spermaceti.

Preparations.

Unguentum Aquæ Rosæ (U. S. P., B. P.).—Rose-water Ointment.
Unguentum Cetacei (B. P.).—Spermaceti Ointment (spermaceti, 20 per cent.; with white wax, benzoin, and almond-oil).
Ceratum Cetacei.—Spermaceti Cerate (10 per cent).

Pharmacology.—Spermaceti is a peculiar, concrete, fatty substance obtained from the head of Physeter macrocephalus (class, Mammalia; order, Cetaceæ), or sperm-whale. It has very little taste or odor, and can be reduced to a powder by the addition of a little alcohol. Unlike ordinary fats, it does not yield glycerin when saponified, but **Ethal.** It is almost pure

Cetin, or palmitate of cetyl. It is not acted upon by a boiling dilute solution of soda, and leaves no grease-spot on paper. Melting point, 50° C. (or 122° F.).

Therapy.—Used almost exclusively as an ingredient in ointments, although an emulsion with wax and yelk of egg is recommended as a demulcent in irritation of the bowels. The unguentum aquæ rosæ, or "cold cream," is an elegant appplication for excoriated surfaces and chapped hands and lips.

CETRARIA.—Iceland Moss.

Preparation.

Decoctum Cetrariæ.—Decoction of Iceland Moss (5 per cent.). Dose, 30 to 120 c.cm. (or f℥i-iv).

Pharmacology.—The sea-weed, Cetraria islandica (Lichenes), is found in northern latitudes. It contains **Lichenin,** or lichen-starch (70 per cent.), which forms a mucilage when hot water is added. Lichenin is a yellowish-white powder which swells up in cold water and dissolves after eight hours' digestion in hot water. There is also cetrarin or cetraric acid, a bitter principle (about 2 per cent.), which can be removed by washing with a weak alkali. Cetrarin occurs in the form of snow-white acicular crystals. It combines with alkalies to form salts. Cetraria also contains small quantities of lichstearic acid. The dried plant was formerly official (U. S. P., 1890).

Therapy.—It has some value as a food, and its demulcent qualities have led to its use in pulmonary affections and bowel disorders in the form of decoction. In such disorders Iceland-moss jelly is an agreeable demulcent. It is made by adding to a quart of boiling water a handful of well-washed moss, the juice of two lemons, one glass of wine, and a quarter of a teaspoon of cinnamon. The moss is first soaked for an hour in a little cold water, then placed in the boiling water and allowed to simmer until dissolved. It is then sweetened, flavored, and strained into molds.

Kobert has ascertained that cetrarin increases intestinal peristalsis, augments the number of red and white blood-corpuscles, especially when they have been reduced by disease, and is a mild stimulant to the central nervous system. It may, therefore, prove of service in chlorosis attended by loss of appetite and constipation. The dose is given as 0.10 to 0.13 Gm. (or gr. iss-ij). Cetrarin, when injected into a vein, causes an increased secretion of saliva, bile, and pancreatic juice. In accordance with this action it has been beneficially employed in dyspepsia.

In Iceland, cetraria is esteemed prophylactic against a prevalent form of elephantiasis. Dr. Eckfeldt states that cetraria possesses antihæmorrhagic power and has been recommended in hæmoptysis. The powder, blown into the nostrils, will arrest epistaxis. A tincture of cetraria is a good application to spongy gums. The therapeutical properties of the lichens have been studied by Dr. Eckfeldt. Rocella tinctoria is astringent, diuretic, and a demulcent expectorant. Species of the genera Usnea and Alectoria are useful, locally and systemically, in hæmorrhoids. Among the Parmelias, several exert an antiperiodic influence. Reindeer-moss is a demulcent tonic, diuretic, astringent, and alterative.

CHAULMOOGRA-OIL.—Chaulmoogra-oil. The expressed oil from the seeds of Hydnocarpus Kurzii, and perhaps also of Gynocardia odorata

(Flacourtiaceæ). The seeds contain **gynocardic acid**, also hydrocyanic acid. The oil is soluble in ether, chloroform, and alcohol.

Gynocardic acid is a yellowish, oily substance, of an acrid, burning taste and distinct odor. In leprosy, chaulmoogra-oil has been used with remarkably good results, both locally and internally. When unable to cure the disease, it has in most cases delayed the progress and mitigated the symptoms. It has been positivly demonstrated that, under the combined internal and external administration of chaulmoogra-oil, the bacilli present in the blood have diminished in number or actually disappeared. The remedy is given in gradually-increasing doses, but is apt to excite intolerance. Recently experiments have been made with chaulmoogra-oil in leprosy by subcutaneous injections. Tourtoulis Bey, of Cairo,[1] relates the case of a Copt, in whom the leprous macules appeared some three months after an attack of fever (evidently leprous fever) at the age of 15. There was no leprosy in the family history, but there were lepers in his native village. He first came under observation at the age of 35, when he presented a characteristically leprous appearance. The patient was given subcutaneous injections of chaulmoogra-oil. Tubes containing 5 c.cm. (or f3j $^1/_4$) of the sterilized oil were prepared in Paris. The improvement was marked after 50 injections. Further injections of 5 c.cm. (or f3i $^1/_4$) each followed, in all during 1895, 193 injections; 106 in 1896, 87 in 1897, 50 in 1898, when the patient refused to have any more, as he considered himself cured. Tourtoulis persuaded the patient to submit to 33 more injections in 1899 (first five months), so that altogether in six years he was injected 584 times, amounting to a total of 2720 c.cm. (or 680 fluidrachms) of the oil. The injections were made on the outer sides of the upper and lower limbs, with a long needle introduced subcutaneously. They gave rise to but slight pain. With the usual antiseptic precautions, Tourtoulis never saw abscesses follow. The author does not wish to conclude from this single case that chaulmoogra subcutaneously will cure leprosy, as there is always the possibility of spontaneous retrogression of lepromata to be borne in mind. In the discussion on Tourtoulis's remarks (Soc. de Derm. et de Syph., Paris, July 13, 1899) Hallopeau pointed out that Jeanselme and he had injected chaulmoogra-oil, 10 c.cm. (or f3ii $^2/_3$) a week, into the buttocks, but in one case there was a severe outbreak of nodules, and this led them to give up this mode of treatment. Du Castel had tried the subcutaneous method at Saint-Louis. Locally, it may be serviceable, combined with other ointments, in treating other skin diseases. Chronic eczema, psoriasis, and lupus are benefited by the application of an ointment containing chaulmoogra-oil. Chaulmoogra-oil has been applied with success in cases of scabies and pediculosis. The ointment has likewise been used upon the enlarged glands of scrofula and in chronic rheumatic arthritis. From 1.20 to 2 c.cm. (or *m*xx-xxx) of the oil to the ounce of excipient is the average strength of the ointment.

℞ Zinci carbonat.,

Pulv. marantæ	aa 4	Gm.	or 3j.
Olei chaulmoograe (*vel* acidi gynocardici)	2	c.cm.	or f3ss.
Ungt. hydrarg. ammoniat.	8	Gm.	or 3ij.
Adipis lanæ hydrosi	15	5 Gm.	or ℥ss.

M. et ft. ungt.

For chronic eczema, psoriasis, scrofuloderma, lupus, and lepra.

[1] *Annales de Derm. et de Syph.*, July, 1899.

Gynocardic acid has been used both externally and internally in leprosy, syphilis, and rheumatic affections. Its dose for internal use is from 0.03 to 0.20 Gm. (or gr. ss-iij), and externally as a local application with oil (10 per cent.).

CHEKAN.—Cheken. The leaves of Myrtus chekan, or Eugenia chekan (Myrtaceæ), a shrub or small tree of South America. It contains tannin and an ethereal oil; also chekenon, chekenic acid, cheken bitter, chekenetin. Of these the ethereal oil alone offers medicinal interest (Weiss). This is antiseptic, diuretic, and expectorant.

Therapy.—Cheken was introduced from Chili through the enterprise of Messrs. Parke, Davis & Co., as a remedy in chronic catarrhal inflammation of the respiratory passages. Dr. Murrell, of London, extols it in the winter-cough of elderly people, and in other forms of chronic bronchitis. In Chili it also enjoys a reputation in the treatment of rheumatism. The dose of the fluid extract is 4 to 11 c.cm. (or f℥i-iij).

CHELIDONIUM.—Chelidonium, Celandine.

Dose, 0.65 to 2.60 Gm. (or gr. x-xl).

Pharmacology.—Celandine is the dried plant of Chelidonium majus (Papaveraceæ), found both in Europe and North America. It contains two alkaloids, **Chelidonine** and **Sanguinarine,** in combination with **Chelidonic Acid.** A bitter, yellow, crystalline principle, **Chelidoxanthine** (Probst), is also present, besides tannic acid, starch, cellulose, etc.

Physiological Action.—It has a bitter, acid taste, and stimulates the secretions of the glands along the intestinal tract, including the liver. In considerable doses it causes vomiting and purging, diaphoresis, and increases the urinary secretion and also the secretions of the bronchial mucous membrane.

Therapy.—The fresh, milky juice may be used as a local irritant, and has been applied upon warts and corns. Internally, in doses of 0.65 Gm. (or gr. x) of the extract, it acts as a drastic purgative, and has been used in jaundice due to catarrhal swelling of the bile-ducts. Dr. Joseph Redmond claims to have had good results from chelidonium in epithelioma of the tongue and of the lip, and also in cases diagnosticated as cancer of the œsophagus and of the liver. It may also be given as a fluid extract, and a recent infusion (an ounce to the pint). Dose, 15 to 30 c.cm. (or ℥ss-j).

CHENOPODIUM.—Chenopodium, American Wormseed.

Dose, 0.65 to 2.60 Gm. (or gr. x-xl).

Preparation.

Oleum Chenopodii (U. S. P.).—Oil of Chenopodium. Dose, 0.30 to 1.20 c.cm. (or *m*v-xx).

Pharmacology.—American wormseed is the dried ripe fruit of Chenopodium ambrosioides, variety Anthelminticum (Chenopodiaceæ), a plant of North America and Europe. It has a peculiar aromatic odor and a warm, bitter taste. Its properties are due to the presence of a peculiar volatile oil, a thin, yellowish, offensively aromatic liquid, which, when distilled, is the official oil.

Physiological Action and Therapy.—The volatile oil acts as a stimulant to the circulation and nervous system, making it serviceable in chorea and neurasthenia. The oil of chenopodium has been employed in hysteria. In Chili, chenopodium is esteemed as an aid to digestion and as an emmenagogue. Dr. Murillo regards it as an excellent carminative in the treatment of infantile colic. Its common use is for the expulsion of lumbricoid worms, and it is best given in doses of 0.60 c.cm. (or *m*x), in capsules or emulsion, three times a day, castor-oil being administered the following day; or the remedy may be administered night and morning for several days, and followed by a brisk cathartic.

Chenopodium album, white goose-foot, lamb's quarter, or hog-weed, a plant common in cultivated ground, and flowering in July and August, is said to possess hæmostatic properties. A tincture made from the leaves and flowers by absolute alcohol is given in the dose of 1 or 2 drops frequently repeated in acute hæmorrhage, and in the same dose, two or three times a day, for the purpose of preventing recurrence of bleeding.

CHIMAPHILA (U. S. P.). — **Chimaphila, Pipsissewa.** (Prince's Pine.)

Preparation.

Fluidextractum Chimaphilæ (U. S. P.).—Fluid Extract of Chimaphila. Dose, 1.20 to 8 c.cm. (or *m*xx-f3ij).

Pharmacology.—The dried leaves of Chimaphila umbellata (Ericaceæ) contain tannin and a colorless, bitter, crystalline, neutral principle, **Arbutin**, and a colorless and tasteless substance, in yellow crystals, **Chimaphilin.** The fresh leaves are also slightly irritating.

Physiological Action and Therapy.—Pipsissewa is diuretic and alterative. The urine is darkened by the use of this remedy. It has very little effect upon the heart or circulation. Upon the digestive organs it is tonic and astringent. As it is not an irritating diuretic, it can be used in Bright's disease and nephritis; also in hæmaturia. In lithæmia, gout, rheumatism, and kindred disorders this is a valuable remedy. As it favors elimination, it has produced good results in scrofula, skin diseases, gleet, leucorrhœa, and intermittent fever. A decoction (62 Gm. to 473 c.cm., or ʒii-Oj) may be used, but a good fluid extract is better.

CHINA-ROOT.—The rhizome of Smilax glabra and Smilax China (Smilaceæ) of China and Japan has the same constituents and properties as sarsaparilla, but is more active. It is best given in the form of fluid extract of China-root, in doses of 2 to 4 c.cm. (or f3ss-j), several times a day.

CHINOIDINUM. — **Chinoidin, Quinoidin,** is a mixture of alkaloids, mostly amorphous, obtained as a by-product in the manufacture of the crystallizable alkaloids of cinchona. (See **Cinchona.**)

Chinoidin possesses tonic and antiperiodic properties. It is a dark-colored substance, and is active in about double the dose of quinine, but is apt to disorder the stomach.

CHINOLINA.—**Chinoline,** or **Quinoline,** a colorless, oily liquid, darkening on exposure to light, is a constituent of coal-tar. It is prepared commercially by treating aniline or nitrobenzol with glycerin in the presence of a dehydrating agent. It may also be obtained by the distillation of qui-

nine, cinchonine, and strychnine with potassium. The odor recalls that of nitrobenzol. It is slightly soluble in water, and the solution possesses a pungent taste. Chinoline is readily soluble in alcohol, ether, and chloroform. It is a hygroscopic substance.

In its chemical characters it is so closely related to quinine as to lead to its substitution in medicine. Dr. Julius Donath claims that its physiological and therapeutic effects are also identical with the natural alkaloid. The tartrate is the salt chiefly used, which is in shining, silky crystals, with penetrating odor and pungent taste, permanent in air, and soluble in water. It is slightly soluble in alcohol; insoluble in ether and chloroform. The free base is highly irritant to the gastric mucous membrane. A salicylate has also been prepared.

Physiological Action and Therapy.—Chinoline is a valuable antiseptic, but its offensive odor has prevented its application in this direction in medicine; however, it is believed that much of this objection can be removed by better modes of preparation. If it could be obtained without odor or taste, it would be a valuable agent for the preservation of food. The tartrate and salicylate are also powerful antizymotics. Internally, these salts are antipyretic and antiperiodic, in doses rather larger than those given of quinine (2 Gm., or 3ss, daily, for adults).

It may be given to children in peppermint-water, or syrup and distilled water, or to adults in capsules or wafers. Neuralgia dependent upon a malarial taint is often relieved by chinoline tartrate. In zymotic diseases, other than malarial, chinoline has not proved satisfactory as an antipyretic, because it has been found to be too depressing in its effects upon the heart. As a topical application in diphtheria, it may be diluted with alcohol (2 per cent.) and used with a spray, or painted on with a brush, to the affected part. A solution of the tartrate ($^1/_2$ to 1 per cent.) has been used as an injection for gonorrhœa.

Analgen, or **Labordin,** is a derivative of chinoline. It is a white, crystalline powder, insoluble in water, soluble in hot alcohol and in acids. It is ortho-ethoxy-ana-mono-benzoyl-amido-quinoline. It has been used with success in neuralgia and has alleviated rheumatic pains. In some cases it causes the urine to assume a dark-red color. This tint is due to a change which analgen undergoes in the organism. The molecule may be entirely destroyed or the benzoyl group which enters into its composition may be separated with complete oxidation of the residue. In the latter event the urine is reddened by the action of the free amido produced in the uric acid. Dose is from 0.50 to 1 Gm. (or gr. viii-xv).

CHINOSOL.—**Chinosol** is described by the manufacturers as a neutral compound of oxychinoline. It is a bright-yellow, crystalline powder, readily soluble in water, not caustic or corrosive, and is said to be non-toxic. It does not coagulate albumin. It is very readily precipitated by alkalies. It has a slightly-aromatic odor and an astringent taste like carbolic acid. It stains the hands yellow; but the color is readily removed by fresh water. It is reported to be forty times more active in checking fermentation than carbolic acid. Chemically, it is oxy-quinoline-potassium sulphate. ($C_9H_6N,OSO_3K + H_2O$).

Physiological Action and Therapy.—Chinosol is antiseptic, disinfectant, deodorant, and bactericide. Professors Emmerich and Kossmann, of

Munich, have used it in surgical work, and prefer it to corrosive sublimate or carbolic acid. Bonnema[1] says that chinosol combines large antiseptic powers with a relatively small power of doing harm. In frogs chinosol showed itself to be a central poison; but he administered to a rabbit 1 Gm. (or gr. xv) by the mouth and one and one-quarter hours later another dose of 2 Gm. (or gr. xxx) without any bad effect. It has a deterrent action upon the coagulation of albumin, and hinders the conversion of albuminoids into peptones. Internally, it has been used with some success in pulmonary tuberculosis. Dr. Alexander MacGregor, of London, reports clinically on six cases, and states that, from the observations which he has been able to make, he is convinced that it is a valuable drug in the treatment of this affection.[2]

CHIRATA (U. S. P., B. P.).—**Chirata (Chiretta).**

Dose, 1 to 2 Gm. (or gr. xv-xxx).

Preparations.

Fluidextractum Chiratæ (U. S. P.).—Fluid Extract of Chirata. Dose, 0.60 to 2 c.cm. (or *m*x-xxx).

Tinctura Chiratæ (B. P.).—Tincture of Chirata (10 per cent.). Dose, 4 to 7.5 c.cm. (or f℥i-ij).

Liquor Chiratæ Concentratus (B. P.).—Concentrated Solution of Chiretta. Dose, 2 to 4 c.cm. (or f℥ss-j).

Infusum Chiratæ (B. P.).—Infusion of Chiretta (5 per cent.). Dose, 15 to 30 c.cm. (or f℥ss-j).

Pharmacology. — The entire plant, Swertia Chirata (Gentianeæ), of India, is used as a bitter aromatic tonic in the East, but rarely prescribed in this country or England. It contains two amorphous principles, **Ophelic Acid** and **Chiratin** (Höhn), but **no tannin.**

Therapy.—Chirata resembles gentian very closely, to which it is allied botanically, but it is more bitter. It has similar therapeutic applications in atonic dyspepsia, etc. Chirata may often be very serviceably combined with bismuth subnitrate, or with hydrochloric acid, for the relief of the sick stomach of drunkards. It is useful in functional inactivity of the liver. By its action on the liver it indirectly overcomes constipation. As it contains no tannic acid, chirata can be prescribed in combination with iron, if desired.

CHLORALFORMAMIDUM (U. S. P.), **Chloralformamide**, or **Chloralamide**, formula $CCl_3CH(OH)NH(HCO)$, is formed by the direct union of formamide, and anhydrous chloral. It is made up of white, granular crystals, which melt at 230° F., and are soluble in water and alcohol. Hot water must not be used in making solutions, as the substance is destroyed above 140° F. It is decomposed by caustic alkalies and alkaline carbonates. Its melting-point is 114° F.; at higher temperatures chloral is liberated. The dose of chloralformamide is 1 to 2.6 Gm. (or gr. xv-xl). It may be given in capsules or cachets, but a much better method of administration is to dissolve it in a portion of wine, whisky, or brandy. Its best effects are obtained when exhibited an hour or an hour and a half before bed-time.

Physiological Action.—Chloralformamide is free from local irritant properties. It has but a slight taste and exerts little or no deleterious influ-

[1] *Therapeutische Monatshefte*, Dec., 1896.

[2] *London Lancet*, vol. ii for 1899, p. 90.

ence upon digestion. It has been given for months continuously without causing any decrease of the bodily weight. The compound has no action upon the bowels or kidneys. According to the testimony of most observers, it exerts little or no depressant influence upon the circulation. Langgaard and Mairet and Bosc, however, state that it reduces blood-pressure, and enjoin caution in its use when organic heart disease exists. Choralformamide is thought to have a stimulating effect upon the respiratory centre. The chief physiological action of this agent is that of an hypnotic. Sleep is often produced within half an hour after its administration. Sometimes drowsiness continues upon the following day. Large doses have occasionally produced headache, vertigo, sickness of the stomach, thirst, incoherence, and cardiac depression.

Dr. Pye-Smith has reported a case in which 5.20 Gm. (or gr. lxxx) of chloralformamide given in two equal portions at eight hours' interval, gave rise to severe universal dermatitis followed by profuse desquamation. There was fever which lasted a week, and the urine was slightly albuminous.

Therapy.—Chloralformamide is principally employed in the treatment of insomnia, especially when due to nervousness, neurasthenia, hysteria, or chronic alcoholism. It has been beneficially used as an adjuvant in epilepsy, and is of value in relieving the paroxysms of cardiac asthma. So far as has yet been observed, the existence of organic disease of the heart is no positive contra-indication to its employment. The effects of chloralformamide, like those of every active drug, require to be carefully watched. Dr. W. Hale White has given it with advantage in several cases of cardiac valvular disease. As a rule, chloralformamide will not overcome sleeplessness caused by pain, though in a number of instances it has succeeded in carcinoma, rheumatism, neuralgia, alcoholic neuritis, herpes zoster, and dysmenorrhœa.

Chloralformamide is efficacious in bronchial asthma, emphysema, pleurisy, and pulmonary tuberculosis by causing sleep, and, consequently, preserving strength. It has, moreover, been successful in overcoming wakefulness attendant upon cirrhosis of the liver, ulcer of the stomach, nephritis, and pelvic disorders. It has likewise, in the same manner, been of service in typhoid fever, erysipelas, and diabetes. This remedy has also a sphere of usefulness in nervous and mental disorders. It is most useful in melancholia and chronic mania. In acute mania, and progressive paralysis, it often fails. It is of service in idiocy with hallucinations, acute and chronic paranoia, periodic psychoses, and multiple neuritis. Chloralformamide is of service in senile dementia, but is useless in cases where excitement is a prominent feature.

In the cerebral disturbances of children it answers a very good purpose, and it has been given with good effect in acute simple meningitis. Dr. Alt, of Halle, has obtained satisfactory results from using chloralformamide in chorea, and Dr. Hexamer, of Stamford, Conn., employed it successfully in alcoholic tremor. As an hypnotic and sedative it is beneficial in whooping-cough, influenza, laryngismus stridulus, and persistent tinnitus aurium. A solution containing 2 Gm. (or gr. xxx) each of chloralformamide and potassium bromide to the ounce is known under the name of **chlorobrom** and is highly recommended by Professor Charteris and others as serviceable in cases of seasickness. It has also been found of value in obstinate vomiting from other causes.

CHLORALUM HYDRATUM.—Hydrated Chloral.

CHLORAL HYDRAS (B. P.).—Chloral Hydrate ($C_2HCl_3O + H_2O$). **Dose,** 0.13 to 1.30 Gm. (or gr. ii-xx).

Preparation.

Syrupus Chloral (B. P.).—Syrup of Chloral (0.65 Gm. in 4 c.cm., or gr. x in f3j). Dose, 2 to 7.5 c.cm. (or f3ss-ij).

Pharmacology.—Chloral hydrate is a crystalline solid, composed of trichloraldehyde, or chloral, with one molecule of water. It is in colorless, transparent crystals; of bitterish, caustic taste; of ethereal, but slightly-acrid odor; soluble in water and in alcohol. Pure hydrate of chloral should be of a neutral reaction. The crystals volatilize slowly at ordinary temperatures, and should be kept in a tightly-stoppered bottle; they melt at 135° F. and boil at 208° F., and are at the same time decomposed into anhydrous chloral and water. Chloral for medical purposes should be recrystallized, and the crystals should be dry, and not readily attract moisture from the air. If concentrated sulphuric acid be added to chloral it is converted into a white, solid substance having the same composition as chloral, but not soluble in water. Chloral also combines with alcohol to form crystals of alcoholate of chloral, which are less soluble than hydrate of chloral. When triturated with camphor, menthol, thymol, or crystals of carbolic acid, hydrate of chloral forms a permanent, oily liquid. In contact with iron, even in small quantity, crystals of chloral-hydrate acquire a peculiar yellow discoloration in consequence of the liberation of free hydrochloric acid.

Physiological Action and Poisoning.—Chloral hydrate is antiseptic and sedative, although slight irritation may occur at first. It is an hypnotic, causing sleep by producing an anæmic condition of the brain, the patient waking after several hours as from natural sleep. Unpleasant after-effects are occasionally observed. The reflex activity of the spinal centres is weakened, and this, extending to the medulla, causes paralysis of the respiratory centre. No effect is seen upon the sensory nerves, but the motor nerves are gradually affected, muscular weakness being one of the prominent phenomena attending chronic chloral poisoning. Chloral acts powerfully upon the heart, lowering and weakening its rate of movement through a local influence upon the ganglion and muscle. With this there is lowering of arterial pressure, aided by dilatation of the superficial vessels. When death is caused by chloral, the heart is arrested in diastole. The decided fall in the bodily temperature is probably secondary to the cooling of the blood by dilatation of the cutaneous blood-vessels. Dyspnœa may be produced by engorgement of the lungs, due to the weakened cardiac action and to the local enlargement of the pulmonary vessels. Death is produced by respiratory failure usually, although it occurs sometimes with such suddenness as to lead to the supposition that it is due to syncope from direct action upon the heart.

In a few cases, death appears to be due to some deleterious action upon the blood, resembling scurvy, as purpuric and scorbutic eruptions occur, with swollen, ulcerated gums, great prostration, and collapse. We treat the first class of cases of gradual respiratory failure, by artificial respiration and the administration of stimulants externally, by friction, local warmth, and sinapisms, and internally by hot coffee, and artificial respiration, galvanism, etc.,

and also physiological antidotes, such as atropine and strychnine. Dr. Colenso recently reported to the London Clinical Society, a case of recovery from chloral poisoning in consequence of the use of atropine and strychnine hypodermically. In the second class of cases, unfortunately, death occurs too quickly for the action of remedies; but hypodermic injections of ether, atropine, or strychnine, with evacuation of the stomach by the pump and the introduction of hot alcoholic stimulants, might be serviceable in saving life. In the third class of cases transfusion of blood might be required, or the administration of large doses of the tincture of ferric chloride. There is a remarkable variation as regards the quantity capable of producing a fatal effect. Cases are on record in which from 15.5 Gm. (or ℥ss) to 31 Gm. (or ℥j) produced alarming symptoms, though recovery took place. On the contrary, death has been caused by a single dose of 2 Gm. (or gr. xxx). Chronic chloralism—presenting symptoms of muscular weakness or paralysis, moral perversion, feeble heart, epileptiform convulsions, and delirium tremens—is relieved by prompt removal of the drug and the administration of tonics, especially nux vomica or strychnine. Animals poisoned with chloral hydrate recover if they are kept warm. In some cases an erythematous rash follows the administration of chloral, and desquamation of skin from the fingers around the extremities has been noticed. Other cutaneous manifestations which have been noticed in consequence of the administration of chloral are wheals, papules, vesicles, pustules, petechiæ, and ulceration. Toxic doses have been followed by symptoms of purpura hæmorrhagica.

An eruption from chloral is especially apt to occur in children, in weak and cachectic patients, and in those who suffer from disease of the nervous system, as hysteria, chorea, myelitis, or general paralysis. The commonest cause of such a rash, however, is the ingestion of alcohol at the same time with chloral.

This substance is removed from the system principally by the kidneys; it also escapes by the breath, to which it gives a peculiar odor. In large amounts chloral is irritant to the kidneys, may excite nephritis, and cause the passage of bloody urine.

It is probable that some of the serious effects following the administration of chloral are properly attributable to impurities in the drug. If the crystals have a pungent, acrid odor, they should not be used; recrystallized chloral hydrate should be preferred for medical use. Where the heart is seriously affected and its walls are thin and weak, chloral, as a rule, should not be given. It is also dangerous to use it freely in alcoholic subjects. According to the experiments of MM. Cadéac and Malet upon dogs, morphine administered by the stomach and soon followed by a rectal injection of chloral produces complete anæsthesia, which continues for more than half an hour.

Therapy.—The antiseptic action of chloral is utilized in surgery, where 5-per-cent. solutions are used as stimulating dressings for suppurating wounds and foul ulcers. This solution also may be applied to parasitic skin affections (tinea versicolor). It is also used to check itching in eczema and prurigo. In urticaria Quinquaud uses a lotion containing 30 parts of boric acid, 5 parts of chloral hydrate, and 180 parts of distilled water. Dr. Marc Sée is in the habit of using an ounce of a 10-per-cent. solution for injection into the sac of an hydrocele after the fluid has been evacuated. In two or three days a large effusion takes place, but is soon absorbed. The same solu-

tion may be advantageously injected into the neighborhood of varicose veins. The blood gradually coagulates and the vessels contract. Dr. J. Palvy, from his experience in fifteen cases, believes that the injection per rectum of a solution containing from 1 to 1.60 Gm. (or gr. xv-xxv) of chloral-hydrate is an efficient remedy in hæmoptysis. In combination with other remedies, it is used as an anodyne and counter-irritant in neuralgia and rheumatism:—

℞ Chlorali hydrati	8	Gm. or ʒij.
Lin. saponis	120	c.cm. or fʒiv.—M.

For application to pleurodynia, lumbago, etc., the combination of chloral and camphor may be used:—

℞ Camphoræ,		
Chloral hydrati aa	4	Gm. or ʒj.
Misce et adde:—		
Adipis lanæ hydrosi	31	Gm. or ʒj.

M. For neuralgia.

Mr. Lennox Browne praises the virtue of a mixture of equal parts of chloral hydrate and camphor as an application in neuralgia. The mixture forms a clear fluid, which is applied over the affected part. He has found it of great service in neuralgia of the larynx and in relieving spasmodic cough and toothache. Chloral is useful in trismus nascentium, the cramps to which pregnant women are often subject, singultus, and spasmodic and nocturnal enuresis. Dr. Lyon Playfair recommends chloral for the purpose of relieving the pain of parturition. It may be administered either by the mouth or rectum, and it is asserted that two or at most four doses of 1 Gm. (or gr. xv) each at intervals of twenty minutes minimize suffering without weakening the energy of the uterine contractions. This remedy has also been used in cases of rigidity of the os uteri. In spasmodic croup Holt advises:—

℞ Chlorali hydrati	5	Gm. or gr. lxxv.
Potassii bromidi	3	Gm. or gr. xlv.
Ammonii bromidi	2	Gm. or ʒss.
Aquæ cinnamomi	60	c.cm. or fʒij.

M. Sig.: Of this the dose for a child about seven years of age is one teaspoonful, to be repeated in twenty minutes if not relieved.

In diphtheria a gargle of 2-per-cent., followed by application of a 20-per-cent., solution is said to cause prompt disappearance of the false membranes.

Two or three grains of chloral to the ounce of water (0.13 to 0.20 Gm. to 30 c.cm.) has been successfully used as an injection in gonorrhœa. Garretson employed the following combination, containing chloral, with good effect, as an injection in gonorrhœa:—

℞ Chlorali hydrati		
Plumbi acetatis aa	50	Gm. or gr. viij.
Aquæ dest.	240	c.cm. or fʒviij.—M.

The principal symptom for which chloral is prescribed is insomnia from mental overwork, or occurring during the course of typhus or typhoid, in delirium tremens, in phthisis, or in the aged. In acute mania, especially that caused by alcohol, very large doses have been followed by the best effects.

When injected (4 to 8 Gm., or ʒi-ij) into a vein, general anæsthesia is produced; but this method has no special advantage, and presents some decided disadvantages. The restlessness and insomnia present in general paralysis of the insane are allayed by the administration of this remedy, and it is also beneficial in spasmodic affections, chorea, whooping-cough, asthma, uterine pains, and tetanus. A dose of chloral at bed-time is useful in paralysis agitans, and may be able to ward off an attack of nocturnal epilepsy. Chloral affords relief in laryngismus stridulus. The hypodermic injection of 0.32 to 0.65 Gm. (or gr. v-x) of chloral-hydrate, in combination with 0.008 to 0.015 Gm. (or gr. $^1/_8$-$^1/_4$) of morphine sulphate, is highly recommended in cholera morbus attended with collapse, and in the algid stage of Asiatic cholera. If the patient cannot be made to swallow, an emulsion may be prepared with egg containing 4 to 8 Gm. (or ʒi-ij) of chloral, and given per enema. This drug also acts as an antidote in cases of poisoning from physostigma, picrotoxin, and strychnine. If, on account of spasm, the patient cannot swallow, the antidote may be serviceably administered by the rectum.

In cases of undue arterial excitement, during the early stage of pneumonia, in overaction of an hypertrophied heart, or in the increased arterial tension of Bright's disease, chloral judiciously used may be of service. It is given with much benefit to allay the discomfort of seasickness. In congestive headache with insomnia a combination like the following is advantageous:—

℞ Chlorali hydrati ..... 4 | Gm. or ʒj.
Morphinæ hydrobromat. ..... | 065 Gm. or gr. j.
Aquæ camphoræ ..... 60 | c.cm. or fʒij.
M. Sig.: A dessertspoonful every two hours until relieved.

It has been found useful in scarlet fever by Wilson, who gives 0.065 to 0.13 Gm. (or gr. i-ij) in a little syrup of lactucarium and water every two or three hours for a child five years of age. Sir Benjamin Ward Richardson esteems chloral as a valuable antipyretic in typhoid fever. In tetanus 0.65 to 1.30 Gm. (or gr. x-xx) should be given every hour or two, according to the gravity of the case, gradually lengthening the intervals and afterward reducing the dose. In convulsions after labor, an enema containing 4 Gm. (or ʒj) of chloral should be thrown into the rectum, or 2 to 2.60 Gm. (or gr. xxx-xl) given by the mouth. Dr. Deshages, of Orleans, advocates the hypodermic injection of chloral in puerperal eclampsia and also in convulsions from other causes. In the convulsions of children it is a very prompt and efficient remedy. For restlessness and insomnia chloral may be very advantageously prescribed with potassium bromide, as:—

℞ Chlorali hydrati ..... 12 | Gm. or ʒiij.
Potassii bromidi ..... 19 | 5 Gm. or ʒv.
Syrupi lactucarii,
Syrupi aurantii ..... aa 60 | c.cm. or fʒij.
M. Sig.: A dessertspoonful at bed-time.

Gioffredi recommends chloral hydrate to be used as an antidote in cocaine poisoning, giving doses of 3 to 4 Gm. (or gr. xlv-ʒj).

For the relief of night-sweats of phthisis, 4 Gm. (or ʒj) may be dissolved in 90 c.cm. (or fʒiij) of dilute bathing-whisky and the patient's skin bathed with it. This is also a good application to prevent bed-sores.

The compounds of chloral with camphor, salicylic acid, and with car-

bolic acid are useful as antiseptics, especially the latter, which is free from unpleasant odor and is anodyne as well as antiseptic.

The unpleasant taste of chloral hydrate may be overcome by mixing its solution with lemonade.

Butyl-chloral-hydrate (B.P.), chloral-butylicum, or croton-chloral (dose, 0.13 to 1.30 Gm., or gr. ii-xx), is obtained by the action of chlorine upon acetic aldehyde and collected by distillation. It is the hydrate of trichlor-butylaldehyde, and is in the form of white, shining, crystalline scales, having a pungent smell and a disagreeable, acrid taste. Butyl-chloral-hydrate is soluble in alcohol, ether, glycerin, and hot water. The action is like that of chloral, but said to be less depressing to the circulation and heart. It is more anodyne, and is especially useful in neuralgia. In neuralgia of the face 0.32 Gm. (or gr. v) is given every half-hour. Liebreich, who was the discoverer of this drug, praises it as an hypnotic in doses of 1 to 2 Gm. (or gr. xv-xxx). Croton-chloral gives relief in headache due to eyestrain, and Ringer has found it very beneficial in migraine. It has also proved serviceable in dysmenorrhœa.

The following combination is recommended in neuralgia:—

℞ Butyl-chloral hydrat.	8	Gm. or ʒij.
Alcoholis	7.5	c.cm. or f3ij.
Elix. guaranæ	90	c.cm. or fʒiij.

M. Sig.: A teaspoonful every half-hour or hour.

A mixture of butyl-chloral and tincture of camphor is recommended as a topical application in neuralgia.

The following formula has been published as of service in migraine:—

℞ Butyl-chloral hydrat.	1	Gm. or gr. xv.
Tr. gelsemii	2	c.cm. or *m*xxx.
Tr. cannabis Ind.	1	c.cm. or *m*xv.
Glycerin	15	c.cm. or fʒss.
Aquæ	q. s. ad 90	c.cm. or fʒiij.

M. Sig.: A third to be taken at once. The dose to be repeated in half an hour.

It may also be administered in the form of a solution containing 10 parts of butyl-chloral and 20 parts of glycerin to 120 parts of distilled water.

From experiments upon frogs Grigorescu states that butyl-chloral is an energetic physiological antidote to strychnine.

Chloral-caffeine. — A molecular combination of chloral with caffeine presents itself in the form of white, shining crystalline scales, easily soluble in cold water. Professor Ewald, of Berlin, has used chloral-caffeine subcutaneously in single doses of 0.20 to 0.28 Gm. (or gr. iii-ivss), or in daily doses of 0.38 to 0.87 Gm. (or gr. vi-xiiiss). The injections ordinarily occasion but little pain. Relief was afforded by this method of treatment in inflammatory rheumatism, sciatica, emphysema, and nephritis. It was also found of service in chronic constipation.

Dormiol is a combination of chloral hydrate with amylene hydrate in equal molecular proportion. It is a colorless oily fluid of a camphoraceous odor, and of a peculiar, though not unpleasantly, pungent taste. Dr. G. Fuchs, the originator of this combination, finds it less liable to cause toxic effects than chloral by itself, "about 24 per cent. more of chloral in the form of dormiol being borne than when taken as uncombined chloral hydrate." He draws the conclusion that the lesser toxicity of the combination is referable to the gradual occurrence and slow progress of disunion of the prepa-

ration. Dr. J. Arnold Goldmann, of Vienna,[1] reports the use of dormiol in twenty-four cases, principally for its hypnotic effect. He found it to have a prompt and reliable hypnotic action and also an undeniable sedative effect, that it can be depended upon to manifest its action in relatively small initial doses of 0.37 c.cm. (or *m*vj); that larger doses, often up to 2 to 3 c.cm. (or *m*xxx-xlv), employed occasionally in individual cases, have no evil consequences. It is said to have no cumulative action, and its long-continued use gives rise to no tolerance. He also found that 0.75 c.cm. (or *m*xij) of dormiol, given with 60 c.cm. (or f℥ij) of gum mixture, as an enema, produced a perfectly satisfactory hypnotic action, the sleep lasting between five and seven hours in a case of a man, 54 years of age, suffering with cancer of the stomach. By the mouth it may be given in capsules of 0.5 c.cm. (or *m*viij) each. One capsule at night is usually sufficient, but in cases of much excitement, such as hysteria, he gave 3 capsules three times a day with only good results.

CHLORALOSE.—Chloralose **(Anhydro-gluco-chloral)** is produced by the action of anhydrous chloral on glucose. It crystallizes in fine needles, is very bitter to the taste, readily soluble in hot water, but dissolves with difficulty in cold water. In the process of manufacture a second substance results. This is known as **Parachloralose,** and crystallizes in the form of fine, pearly lamellæ, which melt at 229° C. (412.2° F.). The melting-point of chloralose is given as 184° to 186° C. (363.2° to 366.8° F.).

Physiological Action.—According to the experiments of Prof. Ch. Richet and Dr. Hanriot, chloralose has a marked hypnotic effect upon dogs, when given in small doses. In large quantities it is toxic. Chloralose stimulates the spinal cord. Reflex action is not diminished, but may even be exaggerated. It is claimed that, even in large doses, chloralose causes no diminution of arterial pressure. Temperature is reduced from one-fifth to three-quarters of a degree. Chloralose is said to produce an increased excretion of urea and chlorides.

Therapy.—From 0.20 to 0.38 Gm. (or gr. iii-vj) occasioned a dreamless and refreshing sleep, which was not followed by nausea or headache. It was administered advantageously in some cases where chloral and morphine had been badly borne. Sleep is generally produced in half an hour after administration of the drug, is tranquil, and unaccompanied by perspiration. Féré has given chloralose in doses from 0.75 to 1.50 Gm. (or gr. xii-xxiv) without ill effects. The effect is maintained from four to ten hours. Large doses have been known to cause flushing of the face, tremors, epileptiform convulsions, headache, uncertainty of speech, and urticaria. A number of cases, however, have occurred in which doses of 0.20 to 0.38 Gm. (or gr. iii-vj) occasioned convulsions or cataleptic symptoms, while cyanosis with collapse has also been observed as the result of moderate amounts. Hysterical individuals are particularly susceptible to its influence. According to Flemming, chloralose is of benefit in functional insomnia and in that due to psychical excitement, hysteria, neurasthenia, overwork, and functional cardiac irritability. He found it of service also in attacks of epilepsy and somnambulism, but states that it fails in wakefulness dependent upon alco-

[1] *Merck's Archives*, Oct., 1900.

holic excitement, multiple neuritis, and any painful organic lesion or peripheral irritation.

In cases of insanity, without excitement, it produces sleep; when excitement is present it will usually act as a sedative, and, at least in some instances, is capable of banishing hallucinations. Dr. J. Sacaze has observed a suppression of night-sweats produced by the administration of chloralose in phthisis. In hectic fever he has used with advantage a combination of quinine and chloralose. This writer has also found chloralose of service in other chronic pulmonary affections, such as chronic bronchitis with bronchiectasis and fetid secretion, accompanied by copious perspiration.

Parachloralose has been thought to possess hypnotic properties, but, according to the experiments of M. Richet, it is an almost inactive body with neither toxic nor therapeutic effect.

CHLORETONE.—This is the trade designation of tri-chlor-butyl alcohol (aceton-chloroform). It is formed by slowly adding equal weights of chloroform and acetone to caustic potash, and is isolated by distillation. It is a white, crystalline solid having a camphoraceous odor. It is sparingly soluble in cold water (1 per cent.), but freely soluble in strong alcohol, chloroform, ether, and glacial acetic acid. Its solutions are antiseptic. Chloretone is a local anæsthetic, resembling cocaine, especially as a substitute in infiltration anæsthesia. On the central nervous system it acts as an anæsthetic and hypnotic, without depressing the nerve-centres. Doses of 0.20 to 0.65 Gm. (or gr. iii-x) in tablet, capsule, or elixir, given at night, quiet nervousness and induce sleep. Dr. Freeman F. Ward has also found it to be of great service in quieting the irritation caused by hyperacidity of the stomach of nervous origin. He stated that it also acted well in whooping-cough, giving one or two doses during the night, of 0.13 Gm. (or gr. ij) dissolved in a little brandy. It is also used in acute alcoholism and in seasickness. In cerebrospinal fever, it has been used for spinal injection. Dr. L. S. De Forest, of New Haven, Conn., after withdrawing from 30 to 50 c.cm. of spinal fluid, introduced 15 to 35 c.cm. of chloretone solution (5 grains in 2 pints).[1]

CHLOROFORMUM (U. S. P., B. P.). — **Chloroform, Trichlormethane** ($CHCl_3$).

Preparations.

Emulsum Chloroformi (U. S. P.).—Emulsion of Chloroform (chloroform, 4 c.cm.; expressed oil of almond, 6 c.cm.; tragacanth, 1.5 Gm.; water q. s. ad 100 c.cm.). Dose, 4 to 7.5 c.cm. (or f3i-ij).

Spiritus Chloroformi (U. S. P., B. P.).—Spirit of Chloroform (6 per cent., U. S. P.; 5 per cent., B. P.). Dose, 2 to 4 c.cm. (or f3ss-j). (For repeated administration, 0.30 to 1.20 c.cm., or *m*v-xx, B. P.)

Linimentum Chloroformi (U. S. P., B. P.).—Chloroform Liniment (U. S. P. contains chloroform, 30 c.cm.; soap-liniment, 70 c.cm.; B. P. contains chloroform, 50 c.cm.; liniment of camphor, 50 c.cm.).

Aqua Chloroformi (U. S. P., B. P.).—Chloroform-water. Dose, 4 to 15 c.cm. (or f3i-iv).

Tinctura Chloroformi et Morphinæ Composita (B. P.).—Compound Tincture of Chloroform and Morphine (chloroform, 75; morphine hydrochloride, 10; diluted hydrocyanic acid, 50; tincture of capsicum, 25; tincture of Indian hemp, 100; oil of peppermint, 1 1/2; glycerin, 250; alcohol, q. s. ad 1000). Dose, 0.30 to 1 c.cm. (or *m*v-xv). In each 0.60 c.cm. (or *m*x) there is 0.05 c.cm. (or *m* 3/4) of chloroform, 0.03 c.cm. (or

[1] *Journal American Medical Association*, Dec. 16, 1905.

*m*ss) of diluted hydrocyanic acid, and 0.0055 c.cm. (or gr. $^1/_{11}$) of morphine hydrochloride.

Mistura Chloroformi et Cannabis Indicæ Composita (N. F.).—Compound Mixture of Chloroform and Cannabis Indica (chloroform anodyne) (chloroform, 125 c.cm. [or ʒiv]; ether, 35 c.cm. [or ʒix]; tincture of cannabis Indica, 125 c.cm. [or ʒiv]; tincture of capsicum, 65 c.cm. [or ʒij]; morphinæ sulphatis, 2.5 Gm. [or gr. xxxvii]; oil of peppermint, 2 c.cm. [or *m*xxx]; glycerin, 125 c.cm. [or ʒiv]; water, 65 c.cm. [or ʒij*m*xl]; alcohol, q. s. ad 1000 (or 2 pints].) Each fluid drachm represents about $7^1/_2$ minims of chloroform, $7^1/_2$ minims of tincture of cannabis Indica, $3^3/_4$ minims of tincture of capsicum, and $^1/_7$ of a grain of morphine sulphate. This preparation is sometimes called "Chlorodyne" (a trade name).

Pharmacology.—Commercial chloroform is impure, only containing 98 per cent. of chloroform, and is used solely for pharmaceutical purposes, as a solvent, or for external application. Official chloroform is a purified chloroform, prepared especially for medical purposes. It is "a liquid consisting of 99 to 99.4 per cent., by weight, of absolute chloroform and 0.6 to 1 per cent. of alcohol." It is a heavy, clear, colorless, diffusive liquid; of a characteristic, pleasant, ethereal odor; a burning, sweet taste; and a neutral reaction. It is obtained by adding chloral hydrate to an alkaline solution, or by the action of chlorinated lime upon ethyl-oxide, or alcohol, and distillation. It is afterward purified by the addition of sulphuric acid, sodium carbonate, and lime, and redistillation. Chloroform is only sparingly soluble in water, but mixes with alcohol and ether in all proportions. It is itself a remarkable solvent, dissolving most alkaloids, resins, gutta-percha, caoutchouc, paraffin, iodine, bromine, fixed and volatile oils, etc. Chloroform is not inflammable, but when mixed with alcohol it may be burned, and chlorine-gas will be evolved. Richardson, of London, has shown that chloroform-vapor, in the presence of a naked flame, is decomposed, forming irritant compounds largely of hydrochloric acid. The accumulation of the fumes in the atmosphere may be sufficient to produce bronchial inflammation. Chloroform-vapor is much denser than atmospheric air, and diffuses slowly. Chloroform is unfit for anæsthetic purposes unless it be absolutely pure and fulfills the tests of the pharmacopœias. "If 5 cubic centimetres (*m*lxxx) of purified chloroform be thoroughly agitated with 10 cubic centimetres (*m*cl) of distilled water, the latter, when separated, should not affect blue litmus-paper (absence of acids), nor test-solution of silver nitrate (absence of chlorides), nor test-solution of potassium iodide (absence of free chlorine). If a portion be digested, warm, with solution of potassa, the latter should not become dark colored (absence of aldehyde). On shaking 10 cubic centimetres (*m*cl) of the chloroform with 5 cubic centimetres (*m*lxxx) of sulphuric acid in a glass-stoppered bottle, and allowing them to remain in contact for twenty-four hours, no color should be imparted to either liquid. If a few cubic centimetres be permitted to evaporate from blotting-paper, no foreign odor should be perceptible after the odor of the chloroform ceases to be recognized." The purified chloroform contains about 0.6 to 1 per cent. of alcohol. It must be kept in glass-stoppered bottles in a cool and dark place.

At the suggestion of Professor Liebreich, M. Pictet, of Geneva, has applied his process for the liquefaction of gases to the production of absolute chloroform. At 70° C. (158° F.) a crystalline body separates from liquid chloroform. The fluid, from which the crystals have been removed, recrystallizes somewhat below 100° C. (212° F.) and the second crystallization represents absolute chloroform. At 15° C. (59° F.) the purified compound

has a specific gravity of 1.51 and is said to be perfectly stable without the addition of alcohol. It has not yet been demonstrated as certain, however, that the Pictet process is superior to the methods of purification heretofore employed. The decomposition of chloroform under the influence of light and air is regarded by some chemists as a natural characteristic of the fluid, and not due to the presence of impurities. It has, in fact, been demonstrated that, without the addition of 1 per cent. of alcohol, Pictet's chloroform undergoes decomposition, and that no sensible difference exists between this and any other well-purified product.

Chloroform was discovered in 1831 by Mr. Samuel Guthrie, of Sackett's Harbor, N. Y., and about the same time by Soubeiran in France, and Liebig in Germany. It was first used as an anæsthetic by Sir James Y. Simpson, of Edinburgh, in 1847.

Physiological Action.—When kept in contact with the skin for some time, it causes irritation and, finally, vesication. After absorption it exerts a sedative effect. Internally, it produces a feeling of warmth in the stomach and acts as a carminative, antispasmodic, and sedative; large doses are irritant. When introduced into the circulation, whether by absorption from the broncho-pulmonary mucous membrane during inhalation or by that of the stomach, the effects are the same. After a brief period of stimulation the depressing effect of the drug is manifested, and in overdoses it is a cardiac poison, acting by destroying the contractility of the heart-muscle.[1] Prof. John A. MacWilliam, of Aberdeen, has demonstrated that, even when gently administered in moderate quantities and with due admixture of air, chloroform causes an appreciable dilatation of the heart. This dilatation may precede the loss of the conjunctival reflex, and affects both sides of the heart. It frequently occurs before any fall of blood-pressure. Artificial respiration, therefore, often fails to revive the patient because the enfeebled and distended heart is unable to maintain the circulation. The dilatation is not produced through the pneumogastrics, but is the direct effect of the drug upon the cardiac mechanism. In a later series of experiments this writer has shown that the primary stage of cardiac acceleration is due to a more or less complete paralysis of the vagi produced by the chloroform. The subsequent retardation occurs "through a depressing or retarding influence exerted on the intrinsic rhythmical mechanism of the organ." The occurrence of anæsthesia is announced by complete muscular relaxation and abolition of the conjunctival and cremasteric reflexes. Dilatation of the pupils while the subject is fully under the influence of chloroform is an ominous sign. Chloroform is eliminated by the lungs and the kidneys. It proves irritant to the kidneys as it escapes from the system, and may set up nephritis.

The administration of chloroform, especially if prolonged, is often followed by the appearance of albumin and casts in the urine: a fact which suggests that the renal secretion should be examined before the patient is placed under the influence of the anæsthetic. It generally kills in Europe and America by heart-paralysis, though, according to the recent report of the Hyderabad Commission to the *British Medical Journal*, in India it kills dogs by failure of respiration. According to Binz, death under chloroform-anæsthesia is generally due to sudden paralysis of the respiratory centre. Sometimes, however, the heart stops before the respiration and again, in

[1] Report of Special Chloroform Committee, *British Medical Journal*, July 22, 1905.

other cases, paralysis of both systems takes place simultaneously. Hare has demonstrated, in the administration of both chloroform and ether, that there is a sudden fall of blood-pressure, during which sudden death may occur from syncope, or heart-paralysis, at an early stage of the anæsthesia. It has no special effect upon the blood, unless the decided lowering of bodily temperature is to be attributed to its action upon the red blood-corpuscles, interfering with their function as oxygen-carriers to the tissues. The absorption of chloroform by different tissues of the body has been studied by Pohl. In the blood of dogs profoundly influenced by the anæsthetic the blood contained much less than it is capable of dissolving, but the red corpuscles held about two and a half times more than the serum. The chloroform is not combined with the hæmoglobin, but with the lecithin and cholesterin of the corpuscles. A larger proportion was found in the brain than in the blood, and Pohl believes that the chloroform is retained by the cholesterin, lecithin, cerebrin, and other substances very soluble in chloroform. The liver contained less than the blood, and only traces were found in the urine. A less quantity was present in the fat than in the blood, which may be attributed to the scanty blood-supply of adipose tissue. Chloroform appears to be absorbed most rapidly and abundantly by tissues rich in substances which are soluble in that liquid. After administration has ceased, the chloroform is reabsorbed by the blood and eliminated by the kidneys. Upon the nervous system the effects are very positive. Chloroform first affects the brain, then the sensory part of the spinal cord, then the motor tract, then the sensory parts of the medulla oblongata, and finally the motor portion of the medulla, thereby producing death from failure of respiration unless the heart has already succumbed to the drug.

Death from syncope, as already pointed out, not infrequently happens from chloroform before complete anæsthesia has been produced. Such accidents are from three to four times more common from chloroform than from ether. According to Sir Benjamin Ward Richardson, chloroform causes death in one of four ways: by apnœal syncope, by epileptiform syncope, by cardiac paralysis, and by shock. That the toxic action of chloroform depends largely upon the presence of impurities is shown by the experiments of du Bois-Reymond. The residue left after the separation of pure chloroform by Pictet's process was found to exert a much more powerful influence upon the circulation and respiration than the purified product.

Attention has been recently directed to the effect of chloroform and ether narcosis on the liver. Bandler, of Prague, performed a herniotomy on an hitherto strong, healthy man, who was, however, a hard drinker, using chloroform as the anæsthetic. A few days afterward icterus developed, and the patient died with cholæmic symptoms. As leucin and tyrosin were found in the urine, *intra vitam*, the diagnosis of acute yellow atrophy of the liver had been made, and it was confirmed by the necropsy. Bandler has been since studying the literature on the subject and experimenting on animals, to determine the exact effect of chloroform narcosis on the parenchymatous organs. He states that every case of chloroform narcosis showed degeneration of the liver-cells afterward, while this degeneration was absent or very slight after ether narcosis. He therefore urges the importance of avoiding the use of chloroform in cases where there is reason to suspect that the liver is not perfectly normal, and using ether instead.[1]

[1] *Journal of the American Medical Association*, Feb. 20, 1899.

At the recent meeting at Nancy, of the Congrès des Sociétés Savantes,[1] Professor Garnier reported the result of a number of experiments made by Dr. Lambert and himself. After the inhalation of chloroform, the glycogen in the liver decreases, while the reductive power of the blood increases. The action of chloroform upon the blood *in vitro* confirmed the results obtained *in vivo*. Garnier believes that under these conditions hydrolysis of the glucose occurs, with the formation of a fermentable sugar belonging to the hexose group.

Therapy.—Chloroform is used as a local sedative, antiseptic, and counter-irritant, and, owing to its solvent action upon the alkaloids, it is a useful vehicle for anodynes. The solution of gutta-percha in chloroform (liquor gutta-perchæ) is sometimes used as a protective in small-pox and erysipelas. This is likewise a useful application in psoriasis, herpes zoster, superficial burns, furuncles, and fissured nipples. Chloroform is an excellent hæmostatic and promptly checks superficial hæmorrhage when applied upon lint or absorbent cotton. A lotion containing chloroform is often of service in urticaria, and a liniment made with chloroform, aconite, and camphor soothes the pain of neuralgia and chronic rheumatism:—

℞ Chloroformi,
Tinct. opii,
Tinct. aconit. ..... aa 15| c.cm. or f℥ss.
Liniment. saponis ..... 75| c.cm. or f℥iiss.
M. Sig.: For external application.

Another good formula for a local anæsthetic is that devised by Dr. Parsons:—

℞ Chloroformi,
Tinct. aconit. ..... aa 11| c.cm. or f3iij.
Tinct. capsici ..... 4| c.cm. or f3j.
Tinct. pyrethri,
Ol. caryophylli ..... aa 2| c.cm. or f3ss.
Camphoræ ..... 2| Gm. or 3ss.
M. Sig.: For external use. The camphor is first dissolved in the chloroform and the oil of cloves and the tinctures are then added.

Chloroform may also be used, as suggested by Southworth, in the following combination to overcome a rigid perineum in labor:—

℞ Chloroformi ..... 60| c.cm. or f℥ij.
Ætheris .... 30| c.cm. or f℥j.
Spiritus odorat. .....473| c.cm. or Oj.
M. Sig.: Apply locally.

This mixture acts quickly and well, large heads safely passing the perineum, which had previously seemed to threaten an extensive rupture. Applied upon a small compress, chloroform hastens suppuration in boils.

Dobisch[2] recommends a combination containing pure chloroform as a spray for its local anæsthetic effect in minor surgical operations, incision of a paronychia, evacuation of a glandular abscess, extirpation of a superficial epithelioma, as follows:—

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[1] *Revue Médicale de l'Est*, 1901, No. 8.
[2] *Allgemeine Medicinische Central-Zeitung*, No. 14, 1890.

℞ Mentholi	4	Gm. or 3j.
Chloroformi	37	c.cm. or f3x.
Ætheris	56	c.cm. or f3xv.—M.

The local anæsthesia lasts from two to six minutes.

Internally it is useful in gastralgia as chloroform-water, or in combination with anodynes, as in chlorodyne. It has also been given in hysteria, asthma, irritable cough, and seasickness.

Chloroform-water has been found serviceable in spasmodic croup. A few drops of chloroform, taken in water or upon sugar, will often relieve vomiting when not due to inflammation of the stomach. Chloroform-water is often of service in alleviating the vomiting of pregnancy. Chloroform, in 0.75 to 1.20 c.cm. (or *m*xii-xx) doses, is said to promote a rapid disappearance of the albuminuria and anasarca of pregnancy. Small doses of chloroform mitigate the pain and check the vomiting caused by gastric ulcer. In this condition it is beneficially combined with bismuth. Chloroform, internally administered, relieves the paroxysms of whooping-cough. In diarrhœa, spirit of chloroform is beneficially added to a mixture containing astringents and opium. The chill of intermittent fever may often be averted by the administration of a drachm of the spirit of chloroform. The same preparation, given alone or in combination with morphine, allays hiccough.

The microbicide action of chloroform makes it serviceable in some cases of flatulent and fermentative or infectious dyspepsia. It has even been claimed to be useful in cholera in this way.

Dr. Werner has used chloroform in 130 cases of typhoid fever. It had a favorable influence upon the diarrhœa and tympanites and lessened the nervous manifestations. None of the patients died or suffered a relapse. He employed a 1-per-cent. aqueous solution, of which he gave 4 to 7.5 c.cm. (or f3i-ij) every hour or second hour, increasing the intervals as improvement occurred. Steep also reports good results from its use in typhoid fever.

The spirit of chloroform is used with especial advantage in the treatment of cholera morbus, and often for its sedative action upon the system.

The spirit of chloroform can be advantageously combined and used with aromatics and other remedies:—

℞ Spiritus chloroformi	15	c.cm. or f3ss.
Aquæ camphoræ, Spiritus ætheris comp.	aa 60	c.cm. or f3ij.
Tinct. capsici	7.5	c.cm. or f3ij.

M. Sig.: A dessertspoonful in water, whenever necessary, for cholera morbus or in stomachache or intestinal pains or flatulence.

℞ Spiritus chloroformi	18.50	c.cm. or f3v.
Creosoti	37	c.cm. or *m*vj.
Spiritus ammon. arom.	7.5	c.cm. or f3ij.
Aquæ menth. pip.	q. s. ad 150	c.cm. or f3v.

M. Sig.: A teaspoonful or two before meals for nausea or vomiting.

℞ Spiritus chloroformi	15	c.cm. or f3ss.
Morphinæ sulphatis	.065	Gm. or gr. j.
Aquæ cinnamomi	q. s. ad 120	c.cm. or f3iv.

M. Sig.: From one to two teaspoonfuls every half-hour for after-pains or in nervous or hysterical attacks.

In fevers the spirit of chloroform is useful to relieve restlessness and

irritative cough in pneumonia, bronchitis, or pleurisy, usually given in a "fever-mixture" combination.

Special Application.—The important application of this remedy is for producing anæsthesia during surgical operations. It is the most pleasant, the most active, and the most convenient anæsthetic. Unfortunately, its death-record is so much higher than that of its great rival, ether, that most surgeons in this country prefer to use the latter, although its odor is not agreeable, and it requires a much larger quantity to produce unconsciousness, and it has a preliminary state of excitement or intoxication. (Remarks upon the state of anæsthesia and the choice of anæsthetics may be found under the head of **Æther.**)

The Administration for Anæsthetic Effect. — The administration of chloroform for surgical operations requires skill, intelligence, and experience. The greater number of fatal cases, by far, have occurred in the hands of those who do not appreciate the responsibility they assume in using this powerful agent. The method to be followed is, first, to eliminate all cases of weak or diseased heart; and, if the operation is to be a long one, requiring prolonged administration of the anæsthetic, cases of kidney disease must also be excluded. The patient should not be in a sitting posture, nor should the chloroform be administered soon after a full meal. The clothing about the neck and waist should be loose enough to allow respiratory movements, but the patient should not be too much exposed, on account of the lowering of temperature and the possibility of congestion of the lungs or kidneys subsequent to the administration. The chloroform should be pure, and about 2.40 to 4 c.cm. (or *m*xl-f3j), poured upon a napkin or towel and held a little distance above the patient's nose or mouth, so that the dense vapor in falling shall mix with air.

According to Clover, the chloroform-vapor should be diluted with 20 volumes of air, and he has devised a special inhaler designed to accomplish this dilution. An improved apparatus, now in use, is known as Dr. Junker's inhaler. In many cases full anæsthesia, or coma, is not needed for small operations, parturition, passage of gall-stones, etc.; consciousness may be preserved while the sense of pain is temporarily abolished. Dr. Sayre, of New York, uses a much smaller amount of chloroform (0.30 to 1.20 c.cm., or gtt. v-xx), but administers the vapor in as concentrated a form as he can, avoiding the admission of air as far as possible, and speaks very confidently of the efficiency and safety of this method. If the patient struggles violently during the inhalation, he is liable to get an overdose, and under such circumstances the administration of the anæsthetic should be entirely discontinued until the breathing becomes normal and it is seen that the anæsthesia is becoming fainter. The experienced anæsthetizer will devote his entire attention to his patient, and carefully note any change in the respiration, pupil of the eye, or color of the skin. The patient's pulse also should be watched during the administration of chloroform, and, if it suddenly stops or becomes fluttering, Nélaton's method should be at once employed, in which the patient is placed in a vertical position, with the head downward, while artificial respiration is employed, which is usually successful. Laborde's method of rhythmical tongue-traction is very useful in restoring the respiration. Tracheotomy may be required, and inflation of the lungs with the bellows has been successfully performed. Sir Benjamin Ward Richardson regards artificial respiration as the most important measure for the

relief of chloroform narcosis. Mouth-to-mouth insufflation may be practiced in the absence of a convenient apparatus. Amyl nitrite or ammonia inhalations should also be practiced, or ether, digitalis, or whisky injected hypodermically. Efforts at resuscitation should not be discontinued in less than one hour, as patients have recovered after artificial respiration had been continued for this length of time. The faradic current is likely to do more harm than good, as it interferes with other measures, and if applied to the phrenic nerve may cause stoppage of the heart by inhibitory action. Slapping the chest and nates with the fringe of a towel wet with cold water was the favorite resource of Professor S. D. Gross. If vomiting occurs after the administration of chloroform, Lewin has found that by wetting a towel with vinegar and placing it on the face of the patient the vomiting will be checked.

Digitalis, hypodermically injected, is a valuable agent in combating the depressant effect of chloroform upon the heart. The conjoined use of strychnine has been practiced on account of its stimulant influence upon the circulation and respiration. Small amounts of alcohol are valueless in this emergency, while large quantities only assist the paralyzing action upon the heart. When danger threatens, the angle of the jaw should be raised and the tongue drawn forward, so that no mechanical impediment shall be offered to free respiration. In the Göttingen clinic, König's method of intermittent compression is practiced in a modified form. The præcordium is rapidly and forcibly compressed at the rate of 120 or more per minute. The air-passages must, at the same time, be sedulously kept free from mucus and open.

Dr. David R. Fly[1] prefers chloroform over ether for general anæsthesia, the one great disadvantage of the former being the care required in the administration. The principal contra-indications to chloroform are heart troubles; emphysema, with dilated right heart; fatty degeneration of the heart-muscle, and uncompensated valvular disease. Ether is also contra-indicated in all these conditions. Neither ether nor chloroform should be administered by artificial light from an open flame, the first because it is inflammable and the second because it becomes decomposed and produces highly irritating vapors, which cause spasm of the larynx, or inflammation of the air-passages. In administering chloroform, it is important to gain the confidence and co-operation of the patient, because struggling and resistance often disturb the judgment and lead to the employment of a larger quantity than is desired. Chloroform ought never to be administered rapidly, for the sudden entrance of a small quantity into the circulation is more dangerous than the gradual absorption of a larger quantity. In major operations, before the administration of the chloroform, it is customary with surgeons to give the patient 15 to 30 c.cm. (or f℥ss-j) of whisky as an arterial and cardiac stimulant. The administration of a dose of nux vomica in the form of tincture or of strychnine as a guard against accident is recommended by Milne and Wigglesworth. Chloroform is also often administered by inhalation for the relief of infantile and puerperal convulsions. In puerperal tetanus the inhalation of chloroform is a valuable measure. A combination of chloroform, given in this manner, and chloral, administered by the mouth in large doses, has been especially praised. Augustus D. Waller, on account of the acknowledged dangers of chloroform, considers it unjustifiable to employ it

[1] *New York Medical Journal*, Nov. 5, 1898.

for minor surgical operations. He condemns the open method of administration on account of the uncertainty of the dosage and its increased risk. This uncertainty of quantity administered can be most easily avoided by following the principles of Junker's method, in which the quantity is accurately measured and its dosage regulated accordingly.[1]

The paroxysms of whooping-cough are checked or moderated by this agent. About 2 c.cm. (or f℥ss) may be poured upon the hand of the mother and held near the child's nose, or it may be vaporized by means of hot water, 0.12 to 0.18 c.cm. (or gtt. ii-iij) being used for each year of the child's age. Used in the latter manner, four times daily, it is said to shorten the paroxysmal stage. In severe cases of chorea, in which the convulsive movements interfere with deglutition and rest, chloroform inhalations answer a very good purpose by inducing sleep, which is followed by notable improvement. Administered at first three times a day, and less often as the symptoms improve, this plan is said to cure the disease, on an average, in twenty-eight days. Chloroform is of value in painful delivery, not given so as to produce unconsciousness, but merely to blunt the sensibility. Used in this way, the uterine contractions are not weakened nor the danger of post-partum hæmorrhage increased. Chloroform is better borne by women in labor than by any other class of subjects. But if pushed to anæsthesia the contractions become less vigorous and hæmorrhage is favored. It is asserted that the inhalation of chloroform for a few minutes at a time, several times a day, is beneficial in phthisis, relieving the cough and reducing the temperature. For this purpose, Fraser recommends also the hypodermic injections of atropine ($^1/_2$ to 1 mg., or gr. $^1/_{120}$-$^1/_{60}$) with morphine hydrochloride (0.005 to 0.008 Gm., or gr. $^1/_{12}$-$^1/_8$) ; for the latter Dr. Laborde substitutes narceine.[2] In sciatica Bartholow has given deep injections of 0.60 to 1.20 c.cm. (or *m*x-xx) of chloroform, near the sheath of the nerve. In some cases this method has also afforded marked relief in facial neuralgia.

CHLORUM.—Chlorine.

Preparations.

Liquor Chlori Compositus (U. S. P.).—Compound Solution of Chlorine. Dose, 2 to 4 c.cm. (or ℥ss-j), well diluted.

Aqua Chlorata.—Chlorine-water (0.4 to 0.5 per cent. chlorine. Dose, largely diluted, 4 to 18.5 c.cm. (or f℥i-v).

Calx Chlorinata (U. S. P.).—Chlorinated Lime (30 per cent. of available chlorine). Dose, 0.20 to 0.38 Gm. (or gr. iii-vj).

Liquor Sodæ Chlorinatæ (U. S. P., B. P.).—Solution of Chlorinated Soda, Labarraque's Solution (2.4 per cent. available chlorine). Dose, 0.60 to 2.6 c.cm. (or *m*x-xl), largely diluted.

Calx Chlorinata (B. P.).—Chlorinated Lime (contains 33 per cent. of available chlorine).

Liquor Calcis Chlorinata (B. P.).—Solution of Chlorinated Lime (about 3 per cent. of available chlorine when fresh).

Javelle water is a French preparation of the above solution, made with potassium instead of sodium. It is also used for disinfection.

Pharmacology.—Chlorine is not itself official. It is a gaseous element, with more than twice the density of air, of a greenish color, strong and suffocating odor, irrespirable, and, even in a state of dilution, very irritating

[1] *The British Medical Journal*, April 23, 1898.

[2] *Therapeutic Gazette*, Sept., 1890, p. 639.

to the air-passages. For disinfecting purposes, it may be disengaged by adding hydrochloric acid to manganese dioxide. Chlorine is soluble in water, and under the influence of sunlight slowly decomposes that liquid, combining with the hydrogen and setting the oxygen at liberty. Owing to the affinity for hydrogen, chlorine acts energetically upon organic substances, and often destroys them. Coloring matters of organic origin are bleached when exposed to its action. Chlorine is an efficacious disinfectant, decomposing hydrogen sulphide and destroying putrefying material. It also destroys the infectious miasms in the air, but should be in excess and in a closed room in order to be very effective. The generation of chlorine in the same room with patients is of very little use so far as disinfection is concerned. The combination with lime (chlorinated lime, or bleaching powder) is largely used for disinfecting drains and cess-pools.

For the sick-room, the solution of chlorinated soda (Labarraque's solution) is more convenient and less offensive, for use in commodes, bed-pans, etc., or for internal administration. The inhalation of ammonia-gas is antidotal to chlorine when absorbed by the air-passages, ammonium chloride resulting from their combination. In cases of accidental poisoning from swallowing a chlorine solution, albumin, in the form of milk, eggs, or flour, is the best remedy at our command, followed by an emetic.

Physiological Action. — Chlorine-gas, in concentrated form, when directed upon the skin, causes smarting and redness, followed by erythematous or pustular inflammation. It is a disinfectant, destroying parasitic vegetable growths. The inhalation of dilute chlorine is irritating to the lungs and stimulates the end-organs of the pneumogastric nerve, causing coughing and strangling sensations. Internally, chlorine was formerly given in various infectious diseases, but this is rarely done at the present day, although Labarraque's solution, or the compound solution of chlorine, has decided influence in maintaining the stomach in an aseptic state during low forms of fever.

Therapy.—Chlorine solution is used to clean offensive ulcers and to remove patches of pityriasis. This liquid is also an excellent disinfectant to sloughing wounds, and may be injected into abscess-cavities, sinuses, or fistulæ, for the purpose of removing and neutralizing unhealthy or decomposing pus.

Schmidt-Rimpler praises the action of chlorine-water as an antiseptic in operations upon the eye. He has found it especially useful in cases of dacryocystitis. In plastic operations upon the lids, traumatisms of the eye, corneal suppuration, and serpiginous ulcer, irrigations with chlorine-water, several times a day, have given satisfactory results. This liquid has the advantage that it does not, like corrosive sublimate, produce corneal infiltrations after the installation of cocaine, but prevents suppuration without injuring the cornea. Chlorine-water was found to be less irritant to the conjunctiva than the mercuric chloride, and, when kept in closely stoppered bottles, excluded as much as possible from the influence of the air and light, remains stable and active for some weeks. It is fit for use as long as it presents the characteristic odor of chlorine. Prior to the operation the conjunctival *cul-de-sac* and globe are washed with chlorine-water, and when completed the lids are covered with muslin compresses wet with chlorine-water and cotton sterilized with corrosive chloride, the whole being fixed by a sterilized bandage.[1] As an antiseptic wash, it may be employed in puerperal

[1] See *Buffalo Medical and Surgical Journal*, May, 1892.

metritis. One part of Labarraque's solution to 10 or 12 of water is a useful injection in vaginitis. The same solution may be used as a prophylactic against poison from bites of serpents or insects. Chlorinated oil[1]—that is, olive-oil saturated with chlorine—is a very efficient remedy in scabies. It acts without irritating the skin.

A compound known as **Chlorophenol** (trichlor-phenol) has been employed as a local application in erysipelas, in the form of a 1-, 2-, or 3-per-cent. ointment. The results are said to have been excellent. It is thought that the remedy would be more efficacious if given by subcutaneous injection.

A combination of chlorine and phenol is highly praised by Dr. J. E. Chambers, of Saint Louis, as a valuable lotion to ulcerated mucous surfaces, as the mouth, nose, and throat, or as an injection into the vagina, uterus, bladder, or rectum, in an inflammatory or ulcerated condition of those organs. A 10- or 20-per-cent. solution was employed. The evaporation of the gas likewise renders the fluid a serviceable disinfectant. Dr. Burney Yeo has had good results from the use of chlorine-water in typhoid fever. Labarraque's solution may be similarly used, much diluted with water. The sore throat of scarlet fever is also benefited by the same methods. Gangrene of the mouth or tongue is likewise amenable to the same influence. According to some observers, chlorine-water has an action upon the liver and is useful in chronic disease of that organ.

The solution of chlorinated lime[2] of the present pharmacopœia is one of the best antidotes to hydrosulphuric acid, ammonium sulphydrate, potassium sulphide, and hydrocyanic acid (given in doses of 1.20 to 4 c.cm., or *m*xx-f℥j). Sheets wrung out of this solution may be wrapped around the body of a person dead of infectious disease or in a decomposing condition. Chlorine-gas has been utilized by Dr. Diver in the treatment of chronic ulcers of the leg. A piece of absorbent cotton was charged with the gas by being placed in a bottle containing about 8 Gm. (or ℥ij) of potassium chlorate, and a drachm or more of hydrochloric acid. The cotton was laid upon the ulcer, covered with gutta-percha tissue, and secured by a bandage. The Shurley-Gibbes plan of treating pulmonary tuberculosis consists in the inhalation of chlorine-gas and the hypodermic injection of gold and sodium chloride. The gas may be evolved from chlorinated lime, from 2 to 23.3 Gm. (or ℥ss-vj) being spread out in a shallow dish and from 1 to 3 drachms of diluted hydrochloric acid added, stirring with a wooden spoon or spatula. It is best to begin with 2 Gm. (or ℥ss) of chlorinated lime, increasing the quantity each day until 12 or 15.5 Gm. (or ℥iii-iv) are used. During the inhalation of the gas the atmosphere of the room should be charged with a spray of saturated solution of sodium chloride. The patient should breathe through the nose, as cough is thus less likely to be excited. The time during which the gas is respired is at first about two minutes. This period is gradually lengthened to twenty or thirty minutes. In mild cases and in laryngeal phthisis the inhalation of chlorine-water suffices.

At the Harper Hospital, Detroit, Mich., a face-inhaler is employed. Chlorine inhalations seem to be of value in arresting the progress of caseation. Hypodermic injections are used in the Shurley-Gibbes method, which is begun by the preliminary administration of iodine. (See **Iodum.**) The

[1] "Chlorinated Oil." See paper by the author, *Medical Bulletin*, 1884, p. 271.

[2] The strength of this solution in the British Pharmacopœia is one avoirdupois pound of chlorinated lime to the imperial gallon.

gluteal region is selected as the proper site of operation. The dose of iodine generally used at first is $^1/_2$ cg. (or gr. $^1/_{12}$) daily, increasing gradually until 0.03 Gm. (or gr. ss) and in some cases 0.065 Gm. (or gr. j) is reached. The gold-and-sodium solution is then injected daily, beginning with 2 or 3 mg. (or gr. $^1/_{30}$ or $^1/_{20}$) and ascending until a dose of 0.012 or 0.02 Gm. (or gr. $^1/_5$ or $^1/_3$) is attained. At this point the quantity should be diminished to 6 mg. (or gr. $^1/_{10}$) daily if the treatment is to be continued. At this stage it is considered better to alternate the injections. If albuminuria occur, the iodine should be suspended. Little or no tendency to hæmoptysis has been observed. Catarrhal manifestations and fever may, in the beginning of the course, be temporarily aggravated, but improvement is said to follow. In some instances, anorexia, listlessness, diarrhœa, and asthmatic symptoms result. Iodine alone cannot be long continued. The alternate use of the remedies prolongs the effect of the iodine. It is recommended that, as a rule, the alternate use should begin in the second or third week of the course, gradually decreasing their use to once or twice a week.[1] The authors of this therapeutical method have, in a number of cases, witnessed improvement as regards symptoms with diminution of physical signs and disappearance of bacilli from the sputum.

CHONDRUS (U. S. P.).—**Chondrus.** (Irish Moss.)

Pharmacology and Therapy.—Chondrus, Irish moss, or carragheen, is the dried plant of Chondrus crispus (Gigartinaceæ), which has been bleached and dried by exposure to the sun. It is in hard, translucent, yellowish-white fragments of sea-weed, with characteristic odor and saline, mucilaginous taste. It contains iodine and bromine in small quantities; its principal constituent is mucilage, but it contains no starch.

Irish moss contains a peculiar principle called **carragheenin**, which is distinguished from gum by not being precipitated from its watery solution by alcohol, and from starch by not turning blue upon the addition of tincture of iodine. Boiled with milk and water (1 to 16) and properly sweetened with white sugar and flavored, it makes *blanc-mange*; or, in more dilute decoction (1 to 100), a demulcent drink for the sick. It has not much food-value, but is deemed useful in bronchial affections.

CHOPPARO AMARGOSO is a small, thorny bush (Simarubaceæ) which grows in southwestern Texas. It bears pink flowers and red fruit. All parts of the plant have an intensely-bitter taste. It seldom creates nausea, has no effect upon the bowels, and seems to be eliminated principally by the kidneys, as its odor is perceptible in the urine. It possesses also some antiperiodic virtues. In large doses it causes flushing of the face and a sense of fullness in the head. Dr. J. W. Mixon, of Wrightsboro, Texas, reports that he has obtained excellent results from the administration of chopparo in dysentery, and suggests that it might prove useful in typhoid fever as an intestinal antiseptic and tonic. A fluid extract of chopparo amargoso has been prepared by Sharpe & Dohme, of Baltimore, the dose of which, as a tonic, is from 0.60 to 15 c.cm. (or *m*x-f℥ss), and as a stimulant from 11 to 30 c.cm. (or f℥iii-f℥j). The plant yields its virtues to boiling water, and is frequently given in the form of a decoction.

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[1] *Therapeutic Gazette*, April 15, 1891.

CHROMII TRIOXIDUM (U. S. P.).—Chromium Trioxide. See **Acidum Chromicum.**

CHRYSAROBINUM (U. S. P.).—Chrysarobin.

ARAROBA (B. P.).—Crude Chrysarobin.
Dose, 0.008 Gm. (or gr. $^1/_8$).

Preparation.

Unguentum Chrysarobini (U. S. P., B. P.).—Ointment of Chrysarobin (5 per cent., with benzoinated lard). (The British ointment is not so strong, being 1 to 24, or only a little over 4 per cent.)

Pharmacology.—Chrysarobin in its commercial, somewhat impure, form is a neutral principle extracted from Goa powder, a substance found deposited in the wood of Vouacapoua araroba (Leguminosæ), which is a native of the East Indies and Brazil. It is an orange-yellow powder, odorless and without taste, nearly insoluble in water and in alcohol, but soluble in ether, sulphuric acid, and solutions of alkalies. It is not identical with chrysophanic acid, as was formerly supposed.

Physiological Action.—In comparatively large doses (2 Gm., or 3ss) it causes irritation of the intestinal mucous membrane, and gives rise to vomiting and purging, with large, bilious stools.

It excites inflammation of the skin from its local application, and produces a yellowish-brown stain of the skin and clothing. (The stain is removable with a weak solution of chlorinated lime or soda.) It is said that hot benzol will remove the discoloration from hair and clothing, provided that no soap or alkali has been used. A yellowish hue is communicated to the urine by chrysarobin. This color turns red upon the addition of alkalies. The dermatitis may be diffuse, or expressed by follicular eruptions. Chrysarobin is parasiticide, and destructive to epiphytic organisms.

Therapy.—The principal internal use of chrysarobin is for its cathartic action. It has been administered internally, in doses of 0.008 Gm. (or gr. $^1/_8$), several times daily in psoriasis. But its extremely-irritant effect upon the intestinal mucous membrane so soon compels its abandonment that it is practically valueless as a systemic remedy. When applied externally for a considerable period, a small portion may probably act by absorption. Chrysarobin ointment should not be allowed to come in contact with the healthy skin, but, in psoriasis, the disease for which it has been principally employed, should be carefully rubbed into the affected area. The parts should then be covered by a bandage in order to protect the linen. Another method of applying chrysarobin is by making a paste of it by means of water, rubbing the paste upon the patches after the scales have been removed, allowing the mixture to harden, and, finally, pencilling collodion over the surface.

Chrysarobin is curative by its stimulating action on psoriasis, chronic acne, and vegetable parasitic skin diseases; but the official ointment should be diluted several times before application, for fear of exciting too much inflammatory reaction. Chronic eczema and the second stage of rosacea also receive benefit from chrysarobin ointment. The same preparation has sometimes proved of service in lupus vulgaris.

A very good combination in chronic eczema and psoriasis is the following:—

℞ Olei cadini	2		c.cm. or f3ss.
Chrysarobini	1	30	Gm. or gr. xx.
Unguent. zinci oxidi	31		Gm. or ℥j.—M.

A 5-per-cent. solution in liquor guttæ-perchæ has been used with advantage in chronic eczema and a 10-per-cent. solution in psoriasis. Dr. Dale James writes that the most cleanly manner of employing chrysarobin is by dissolving 1 part in 7 parts of chloroform, and stirring about an equal quantity of soft petroleum into the mass. The preparation is applied by means of a brush. Chrysarobin has been recommended by Dr. Robinson, of New York, as an excellent application in alopecia circumscripta. It may be conveniently used in the form of a stick, made up according to the following formula slightly modified from that given by Dr. Leistikow, of Hamburg:—

℞ Chrysarobini	31		Gm. or ℥j.
Colophonii (vel resinæ)	4		Gm. or ℥j.
Ceræ flav.	31		Gm. or ℥j.
Ol. olivæ	30		c.cm. or f℥j.—M.

Euroben, or chrysarobin tannate, soluble in chloroform, acetone, and ether, is used as a *succedaneum* for chrysarobin, especially as a skin varnish for chronic scaly skin eruptions.

CIMICIFUGA (U. S. P.).—**Cimicifuga, Black Snake-root, Black Cohosh.**

CIMICIFUGÆ RHIZOMA (B. P.). — **Cimicifuga, Actææ Racemosæ Radix.**

Dose, 1.30 to 2 Gm. (or gr. xx-xxx).

Preparations.

Fluidextractum Cimicifugæ (U. S. P.).—Fluid Extract of Cimicifuga. Dose, 0.30 to 2 c.cm. (or *m*v-f3ss).

Extractum Cimicifugæ (U. S. P.).—Extract of Cimicifuga. Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Tinctura Cimicifugæ (U. S. P., B. P.).—Tincture of Cimicifuga (20 per cent.; the British tincture is only 10 per cent.). Dose, 4 to 7.5 c.cm. (or f3i-ij). B. P., 2 to 4 c.cm. (or f3ss-j).

Extractum Cimicifugæ Liquidum (B. P.).—Liquid Extract of Cimicifuga. Dose, 0.30 to 2 c.cm. (or *m*v-xxx).

Pharmacology.—The dried rhizome and roots of Cimicifuga racemosa (Ranunculaceæ), a plant common in woods in northern United States, contain a neutral principle of acrid taste, soluble in dilute alcohol, water, chloroform, or ether. Its chemical nature is not known positively. Mr. George H. Davis has discovered a volatile oil in the recently-gathered roots; and Prof. George B. Wood thought that this might be the active principle, since sides the volatile oil, some tannic and gallic acids. The odor of the plant is rather fetid.

Physiological Action.—Cimicifuga has decided effects upon the human system. Small doses stimulate the digestive function and increase secretions along the alimentary canal. The secretions of the bronchial mucous membrane are also increased, the action of the heart stimulated, and the urine the drug deteriorates upon keeping. It also contains two resins. So-called **cimicifugin,** or **macrotin,** is an impure resin, deposited from the concentrated tincture upon the addition of water. There is also in the recent drug, be-

is augmented in quantity. The menstrual flow is increased, and some aphrodisiac qualities have been ascribed to the drug. Upon the heart and circulation an effect is noticed resembling that of digitalis, though less marked. Full doses slow the pulse and increase its force, raise arterial tension, and stimulate uterine contraction; the latter action recalls that of ergot, though it is less powerful. Cimicifuga lowers the reflex activity of the spinal cord. The pupils are dilated; dimness of vision, vertigo, intense headache, nausea, and vomiting result from large doses. Even soporific effects have been observed, with relief from pain or spasm. Death may be caused by failure of respiration.

Therapy.—The applications of cimicifuga are in accordance with its physiological activity. Externally, a saturated tincture is said to relieve pain in rheumatism and neuralgia. In chorea it is of decided value, especially in weak anæmic children. It is, moreover, very applicable to those cases which manifestly depend upon rheumatism, or to those which develop in girls at the age of puberty and are associated with menstrual irregularity. In neuralgia, especially when the consequence of rheumatism, cimicifuga is of undoubted benefit. In certain cases of sciatica improvement follows the administration of this agent.

A formula of Dr. Metcalf for sciatica is:—

℞ Tr. aconit.,
Tr. colchic. sem.,
Tr. belladonn. fol.,
Tr. cimicifugæ ..... aa 7|50 c.cm. or f℥ij.
M. Sig.: Six drops every six hours.

Cimicifuga was introduced into England by Sir J. Y. Simpson, as a remedy for chronic rheumatism, myalgia, and hypochondriasis with depression. It is beneficial in melancholia, especially when that condition is associated with functional or organic uterine or ovarian disorder. Cimicifuga is likewise serviceable in some cases of acute rheumatism, and Ringer has found it useful in rheumatoid arthritis. The fluid extract is the best and most reliable preparation. In uterine subinvolution, ovarian neuralgia, and amenorrhœa it is highly commended. It has a good effect, also, in other constitutional manifestations dependent upon disorder of the female generative system, as, for instance, convulsions caused by disturbance of the catamenial function, and in puerperal mania. Congestive dysmenorrhœa is likewise relieved by this remedy. Cimicifuga is often beneficial in menorrhagia and metrorrhagia. By reason of its action upon the womb, cimicifuga may be employed during parturition as a substitute for ergot. Though not so powerful as the latter drug, it strengthens the normal uterine contractions. For its tonic effects, it is used in treating gastric catarrh and irritable stomach of alcoholism; also in delirium tremens and functional impotence. In weak and fatty heart it is safer than digitalis. On account of its stimulating effects upon the uterus, it should not be given during pregnancy.

In headache from eyestrain cimicifuga has been given with benefit, and is especially useful in acute bronchitis as an expectorant. Cimicifuga is likewise valuable in chronic bronchitis attended by profuse muco-purulent secretion. It may even be serviceably prescribed in phthisis, as it facilitates expectoration, sustains the appetite and digestion, and reduces fever.

Cimicifuga may be administered as in the appended formulæ:—

℞ Fluidext. cimicifugæ	45	c.cm. or f℥iss.
Tinct. nucis vomicæ	4	c.cm. or f℥j.
Tinct. cinchonæ comp. .....q. s. ad	150	c.cm. or f℥v.

M. Sig.: A teaspoonful or two in water every three or four hours. For ovarian and uterine neuralgia and amenorrhœa.

℞ Fluidext. cimicifugæ	30	c.cm. or f℥j.
Morphinæ sulphatis		065 Gm. or gr. j.
Spiritus ætheris nitrosi,		
Liquor ammonii acetatis ..... aa	60	c.cm. or f℥ij.

M. Sig.: Two teaspoonfuls in water every three or four hours. For neuralgia, acute rheumatism, and acute bronchitis.

℞ Ext. cimicifugæ	1	55 Gm. or gr. xxiv.
Ext. belladonnæ folior.		065 Gm. or gr. j.
Pulv. capsici		75 Gm. or gr. xij.

M. et ft. pil. no. xij.

Sig.: From one to two pills three times a day. For gastric catarrh, delirium tremens, and functional impotence.

CINCHONA (U. S. P.).—**Cinchona, Peruvian Bark.**

CINCHONA RUBRA (U. S. P.).—**Red Cinchona.**

CINCHONÆ RUBRÆ CORTEX (B. P.).—**Red Cinchona-bark.**

U. S. P. Preparations, Alkaloids, and Salts.

Fluidextractum Cinchonæ.—Fluid Extract of Cinchona. Dose, 0.60 to 7.5 c.cm. (or *m*x-f3ij).

Tinctura Cinchonæ.—Tincture of Cinchona (20 per cent.). Dose, 2 to 7.5 c.cm. (or *m*xxx-f3ij).

Tinctura Cinchonæ Composita.—Compound Tincture of Cinchona (red cinchona, 10; bitter orange-peel, 8; serpentaria, 2; glycerin, 7.5; alcohol and water, q. s. ad 100 parts). Dose, 4 to 15 c.cm. (or f3i-iv).

Quinina.—Quinine. A white, amorphous powder, soluble in 1670 parts of water and in 6 parts of alcohol. Dose, 0.065 to 0.65 Gm. (or gr. i-x).

Oleatum Quininæ.—Oleate of Quinine (25 per cent.).

Quininæ Sulphas.—Quinine Sulphate. Dose, 0.065 to 0.65 Gm. (or gr. i-x). In snow-white, loose, filiform crystals, fragile, and in a light, easily-compressible mass; lustreless (owing to superficial efflorescence), odorless, having a persistent bitter taste and neutral reaction. Soluble in 740 parts of water, and in 65 parts of alcohol at 15° C. (59° F.), in small proportions of acidulated water. Very slightly soluble in ether. Aqueous solution, especially if acidulated with sulphuric acid, has a vivid, blue fluorescence. When treated first with fresh bromine-water, and then with slight excess of water of ammonia, the salt produces an emerald-green color (*thalleioquin*). Crystals are formed of the same color by treating an acidulated solution of quinine sulphate with saturated alcoholic solution of iodine (*herapathites*).

Quininæ Bisulphas.—Quinine Bisulphate. Dose, 0.065 to 1 Gm. (or gr. i-xv). Similar to the sulphate, but much more soluble, dissolving in 10 parts of water or 32 parts of alcohol at 59° F.

Quininæ Hydrobromidum.—Quinine Hydrobromide. Dose, 0.065 to 1.30 Gm. (or gr. i-xx).

Quininæ Hydrochloridum.—Quinine Hydrochloride. Dose, 0.065 to 1 Gm. (or gr. i-xv). Soluble in 34 parts of water.

Quininæ Salicylas.—Salicylate of Quinine. Dose, 0.065 to 1 Gm. (or gr. j-xv).

Cinchoninæ Sulphas.—Cinchonine Sulphate. Dose, 0.32 to 2 Gm. (or gr. v-xxx). In white needles, soluble in 66 parts of water and in 10 parts of alcohol. Very bitter.

Cinchonidinæ Sulphas.—Cinchonidine Sulphate. Dose, 0.32 to 2.60 Gm. (or gr. v-xl).

Ferri et Quininæ Citras.—Iron and Quinine Citrate (contains 12 per cent. of quinine, 85 of ferric citrate). Dose, 0.13 to 0.65 Gm. (or gr. ii-x).

Ferri et Quininæ Citras Solubilis.—Soluble Iron and Quinine Citrate. Dose, 0.20 to 0.65 Gm. (or gr. iii-x).

Elixir Ferri, Quininæ, et Strychninæ Phosphatum.—Elixir of Iron, Quinine, and Strychnine Phosphate. Dose, 4 to 8 c.cm. (or 3j-ij).

Glyceritum Ferri, Quininæ, et Strychninæ Phosphatum.—Glycerite of the Phosphates of Iron, Quinine, and Strychnine (used in making the syrup). Dose, 1 to 4 c.cm. (or *m*xv-3j).

Syrupus Ferri, Quininæ, et Strychninæ Phosphatum.—(See *Ferrum.*) Dose, 4 c.cm. (or 3j).

Vinum Ferri Amarum.—Bitter Wine of Iron. Dose, 4 to 7.5 c.cm. (or f3i-ij).

B. P. Preparations, Alkaloids, and Salts.

Extractum Cinchonæ Liquidum.—Liquid Extract of Cinchona (5 per cent. of alkaloids). Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Infusum Cinchonæ Acidum.—Acid Infusion of Cinchona (red cinchona-bark, 50 Gm.; aromatic sulphuric acid, 12.5 c.cm.; distilled water, 1000 c.cm.). Dose, 15 to 30 c.cm. (or f℥ss-j).

Tinctura Cinchonæ.—Tincture of Cinchona (1 Gm. of alkaloids to 100 c.cm., made with red cinchona-bark). Dose, 2 to 4 c.cm. (or f3ss-j).

Tinctura Cinchonæ Composita.—Compound Tincture of Cinchona (bitter orange-peel, 50; serpentary, 25; cochineal, 3.2; saffron, 6.3; tincture of cinchona, 500 c.cm.; alcohol, q. s. ad 1000). Dose, 2 to 4 c.cm. (or f3ss-j).

Quininæ Sulphas.—Quinine Sulphate. Dose 0.065 to 0.65 Gm. (or gr. i-x). In silky-white filiform crystals, taste very bitter. Soluble in about 800 parts of water, the solution having a bluish fluorescence; when water is acidulated with a mineral acid the salt is entirely soluble. When solution of ammonia is added to aqueous solutions of quinine salts, it forms a white precipitate soluble in ether and in excess of the solution of ammonia. Quinine sulphate when exposed to dry air, the 15 molecules of water are reduced to 4, due to efflorescence.

Quininæ Hydrochloridum.—Quinine Hydrochloride. Dose, 0.065 to 0.65 Gm. (or gr. i-x).

Quininæ Hydrochloridum Acidum.—Acid Quinine Hydrochloride. Dose, 0.065 to 0.65 Gm. (or gr. i-x).

Tinctura Quininæ.—Tincture of Quinine (quinine hydrochloride, 2; tincture of orange, 100). Dose, 2 to 4 c.cm. (or f3ss-j).

Tinctura Quininæ Ammoniata.—Ammoniated Tincture of Quinine (quinine sulphate, 2; solution of ammonia, 10; alcohol, 90 c.cm.). Dose, 2 to 4 c.cm. (or f3ss-j).

Syrupus Ferri Phosphatis cum Quinina et Strychnina. (See *Ferrum.*)

Vinum Quininæ.—Quinine-wine (quinine hydrochloride, 2 Gm.; orange-wine, 875 c.cm.). Dose, 15 to 30 c.cm. (or f℥ss-j).

Pilula Quininæ Sulphatis.—Pill of Quinine Sulphate (quinine sulphate, 30; tartaric acid, 1; glycerin, 4; tragacanth, 1; to make a pill-mass). Dose, 0.13 to 0.50 Gm. (or gr. ii-viij).

Ferri et Quininæ Citras.—Iron and Quinine Citrate. Dose, 0.32 to 0.65 Gm. (or gr. v-x).

Some **Unofficial** *Preparations.*

Extractum Cinchonæ.—Extract of Cinchona. Dose, 0.06 to 0.65 Gm. (or gr. i-x).

Quininæ Valerianatis.—Valerianate of Quinine. Dose, same as sulphate.

Cinchonina.—Cinchonine. Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Quinidinæ Sulphas.—Sulphate of Quinidine. Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Chinoidinum.—Chinoidine. Dose, 0.20 to 2 Gm. (or gr. iii-xxx). A mixture of the alkaloids, in an amorphous form, and dark colored; obtained from the residue left from the manufacture of the crystallizable salts.

Quininæ Hydrochloras Carbamidata.—Double Salt of Quinine and Urea. Soluble in an equal part of water, and used hypodermically in congestive chills. Dose, 0.065 to 0.65 Gm. (or gr. i-x).

Quinetum, or Hospital Quinine, is the mixed alkaloids precipitated by an alkali; largely used as a febrifuge in India. Dose, about the same as quinine.

Cinchonidinæ Salicylas.—Cinchonidine Salicylate. Dose, 0.13 to 0.65 Gm. (or gr. ii-x).

Cinchoninæ Iodosulphas.—Cinchonine Iodosulphate (50 per cent. iodine). A substitute for iodoform.

Pharmacology.—The **Cinchona** of the United States Pharmacopœia is the dried bark of Cinchona Ledgeriana (Molus); Cinchona Calisaya (Wed-

dell); Cinchona officinalis (Linné); and of hybrids of these and of other species of cinchona (family, Rubiaceæ), yielding, when assayed by the official process, not less than 5 per cent. of anhydrous cinchona alkaloids, of which at least four-fifths should be soluble in ether. **Cinchona rubra** (U. S. P.), is the dried bark of Cinchona succirubra (Rubiaceæ), yielding not less than 5 per cent. of anhydrous cinchona alkaloid. **Cinchona Rubræ Cortex** (B. P.) is the dried bark of the stem and branches of cultivated plants of Cinchona succirubra; "when used for purposes other than that of obtaining alkaloids or their salts, it should yield between 5 and 6 per cent. of total alkaloids, of which not less than half should consist of quinine and cinchonidine." Cinchona flava (non-official), which is the bark of the trunk of Cinchona Calisaya, contains at least 2 per cent. of quinine. There have been isolated from cinchona-bark about twenty alkaloids, differing slightly in physical qualities, solubility, reaction, and affinities, but all possessing, to greater or less degree, the characteristic physiological actions of quinine. They may be divided into two groups: (1) **quinine, quinidine,** and **quinicine**; (2) **cinchonine, cinchonidine,** and **cinchonicine.** These exist in the bark combined with cincho-tannic, kinic, and kinovic acids, with a tasteless, inactive substance,—cinchona-red. While South America remains the principal source of cinchona, yet the cultivation of the tree has been so successfully carried on in India and Java that a considerable portion of the supply is now derived from this source. The constantly-growing demand for quinine has stimulated chemical investigation; and laboratory products, chiefly of the coal-tar series, are now offered in great variety, which closely approach the cinchona alkaloids in physical and chemical characters, and which also have been proved valuable as antipyretics. Prominent among these are chinoline, antipyrin, acetanilide, resorcin, kryofin, and naphthalin, which will be considered separately under their individual titles. Thus far, however, no synthetically-prepared salt rivals quinine and cinchonine in their control of malarial manifestations, or in their tonic effects upon the system when given for a length of time in small doses.

By chemical modification of **cupreine,** a base found in the Remijia pedunculata, MM. Grimaux and Arnaud have, by synthesis, obtained a substance absolutely analogous to, and perhaps identical with, quinine. They have also derived other bodies similar to quinine, which are ethers of cupreine and are endowed with decided physiological properties. Quinine is chemically the methylic ether of cupreine. By following a similar process to that by which cupreine is transformed into quinine, two new alkaloids have been discovered. Ethylic cupreine has been denominated quinethyline and propylic cupreine has been given the name of quinopropyline.

With regard to the comparative alkaloidal value of the different barks, the C. Calisaya contains the greatest proportion of quinine, the C. succirubra the greatest amount of tannin and coloring matter. Under the name of pale barks, the C. micrantha and C. condaminea were formerly official; they are intermediate between the two just named, in their alkaloidal value. The C. pitayensis, cuprea-bark, and other quinine-yielding barks are employed in manufacturing the alkaloids, but are not specifically named by the pharmacopœias; all are official which contain at least 5 per cent. of the total alkaloids of cinchona and 2.5 per cent. of quinine.

Quinine sulphate is a snow-white crystalline substance of a silky lustre,

which becomes somewhat opaque in dry air from efflorescence. It becomes yellowish on exposure to sunlight, is phosphorescent on trituration at 320° F. At a red heat it decomposes and burns slowly without any residue. This salt is soluble in 740 parts of cold and 30 parts of boiling water, is readily soluble in alcohol and acidulated solutions, and in glycerin. It dissolves sparingly in chloroform and is nearly insoluble in ether. A delicate test for quinine is the production of an emerald-green color when a solution of one of its salts is treated with bromine-water followed by the addition of aqua ammonia in excess.

Physiological Action.—The preparations of the bark are not fully represented by the salts of the alkaloids, because they possess astringency, which is absent from the latter, and because the physiological action is increased by the association of different principles in accordance with the well-known rule of combination of synergistic remedies. For internal administration, however, the bulk of the powdered bark is inconveniently large. In 1820 Pelletier and Caventou first isolated quinine, which has since taken the leading place in therapeutics of fever, and is second only to morphine in importance. As the other salts approximate more or less closely to this, we may omit consideration of their physiological action and simply take quinine as the type. Quinine is a powerful antiseptic, and is very destructive to infusorial and vegetable life. A solution of $^1/_5$ of 1 per cent., 0.065 Gm. to 30 c.cm. (or gr. i-f℥j), destroys micro-organisms, and double this strength prevents fermentation and putrefaction. Upon the basis of his numerous experiments, Binz concludes that the remedial action of quinine in malaria is due to its direct action upon the specific micro-organism of the disease. Upon the sound skin very little effect is, as a rule, produced, but upon a part denuded of epidermis, or upon mucous membranes, it is a decided irritant. Rashes, however, may be caused by the direct action of cinchona. Workmen employed in making quinine are not infrequently attacked by erythema, vesicles, or pustules. It causes muscular contractions when applied directly to the muscle, but not when applied to a nerve (Eulenberg). It is therefore a muscle-irritant, and not a nerve-irritant. Taken into the stomach, it exercises a local effect upon its contents, checking abnormal fermentation and destroying infectious micro-organisms. For this purpose it should be given in solution or in powder (capsule), so as to insure its solution in the stomach. In moderate doses it stimulates the muscular fibres of the stomach, increasing its motor power, and also, by its irritant action, increases the secretion of gastric juice and, as a bitter tonic, improves the appetite. In large quantities, hunger is abolished, and the excess of irritant action causes arrest of gastric secretion.

In excessive doses it may cause nausea and vomiting. Its prolonged use in large amounts has been known to cause gastritis. No influence has been noticed upon respiration, and very little upon temperature of a person in health. In conditions of fever, the administration of several full doses reduces the temperature nearly to the normal; and there appears to be a tolerance during this condition, for the system can stand a much larger quantity at a dose than it can in health, without producing toxic effects. This may, in part, be due to the fact that absorption is checked by the fever. The effect upon the nervous system of small doses is best seen in cases of debility, where the agent acts as a tonic, invigorating the vital functions and aiding the digestion and assimilation of food. In larger doses, symptoms referable to the

brain are noticed, such as fullness, frontal headache, deafness, ringing in the ears, and mental dullness. These symptoms are attributed to partial anæmia of the brain, owing to contraction of blood-vessels and lowered heart-action, possibly to direct action upon the multipolar cells, analogous to the action of morphine. There is stimulation of the sympathetic and auditory nerves (Gubler). With deafness there is associated disturbance of vision or temporary blindness, due to extreme contraction of the arterioles and anæmia of the retina, the optic nerve being perfectly white, resembling white atrophy. This condition of the eye-ground is more or less permanent, but the function of vision is restored. Amblyopia has been produced in an extremely-susceptible individual by so small a dose as 0.13 Gm. (or gr. ij).

Large doses lower or abolish the reflex excitability of the spinal cord. Soon after being introduced into the stomach it diffuses into the blood and may be detected in the urine, elimination taking place slowly and lasting for several days. The quantity of urine is slightly increased in persons unaccustomed to its effects; the uric acid is decreased and urea not constantly affected. Medicinal, and especially massive, doses of quinine have, however, been observed to cause a marked decrease in urea, and it is thought that the diminished elimination of nitrogenous waste depends upon a depressant influence exerted by this drug upon tissue-changes within the body. Full doses of quinine may cause congestion of the genito-urinary tract.

Quinine probably escapes from the system by other routes, as it has been detected in the sweat, tears, and milk of nursing women. It has been found also in bile and in dropsical effusions. In the blood, quinine arrests the migration of the white corpuscles and checks their amœboid movements; the red cells are rendered less adhesive and their oxygen-carrying function is impaired. The experiments of Sokoloff upon rabbits show that quinine exerts a favorable influence upon the healing of wounds. Inflammatory degeneration of tissue is notably decreased. It probably tends to destroy infectious micro-organisms in the blood and tissues. The pulse-rate is increased by moderate doses, but larger ones (4 to 6 Gm., or ʒi-iss) cause lowering of the pulse and of arterial tension. In animals death results from paralysis of respiration after large doses of quinine. In the human subject very few well-attested cases of death following the ingestion of quinine are on record. Recovery has followed the use of such enormous quantities as 15.5 or 46.5 Gm. (or ℥ss-iss), though it is very probable that in such cases the entire amount was not absorbed. In Bazire's case death was caused by 155.5 Gm. (or ℥v) taken in the course of ten days. In some patients various forms of eruption have been noticed upon the skin, even purpura.[1] A scarlatiniform eruption occasionally follows the ingestion of a small dose of quinine. In other instances the eruption has resembled that of measles or erysipelas. Desquamation is a sequence, and may be prolonged. The rash is often attended by severe burning and itching sensations.

The artificial alkaloids derived from the cinchona bases generally exert a more decided influence upon temperature than does quinine, causing a reduction of several degrees even in healthy individuals. When injected subcutaneously these substances also produce total anæsthesia of the neighborhood into which they are thrown. Cupreine is slightly toxic, and does not occasion convulsions. Quinethyline produces tremor and the symptoms

[1] Cases by Dr. Frank Woodbury reported to State Medical Society of Pennsylvania, *Philadelphia Medical Times*, Sept. 18, 1886.

of quinine intoxication. Quinopropyline is the most toxic member of the series, and causes a profound stupor.

Poisoning.—The toxic symptoms produced by quinine and allied salts are spoken of collectively as **Cinchonism,** which ordinarily is not allowed to go further than tinnitus aurium. Where these symptoms are annoying, or the patient is suffering from an overdose, the alimentary tract should be cleared by a purge, and brandy and a cup of hot coffee administered, or a dose of ergot. Where there is much irritation of the skin, urticaria, or erythema, a warm bath containing sodium bicarbonate is useful; an hypodermic injection of morphine may be necessary. Dilute hydrobromic acid (2 to 7.50 c.cm., or f℥ss-ij), given with ordinary doses of quinine, prevents the occurrence of ringing in the ears or headache. Some patients show idiosyncrasy to the effects of quinine; urinary irritation, even congestion of the kidneys and hæmorrhages, may follow quite a small dose. Some, indeed, cannot take a single grain without great inconvenience from cinchonism. It must, therefore, be given with caution when cystitis is present. Quinine will also, in some individuals, occasion decided irritation of the gastro-intestinal mucous membrane.

A case has been reported by Dr. Krannhals in which the administration of 0.20 Gm. (or gr. iij) of quinine to a young woman was followed by high fever, bloody vomiting, and bloody diarrhœa. Erlenmeyer has recently described a case in which the nervous reflexes were greatly exaggerated after the administration of a single dose of 1 Gm. (or gr. xv) of quinine, followed by 2 Gm. (or gr. xxx) in broken doses on the succeeding day. Examination of the patellar reflex at that time occasioned a series of general convulsions, with violent contraction of the arms and the entire body. Quinine is eliminated rather slowly and principally by the kidneys.

Therapy.—The application of powdered bark was formerly one of the accepted methods of treatment of ulcers, but is now obsolete. A 1-per-cent. solution of quinine sulphate is recommended as a topical treatment of sluggish, unhealthy, infected wounds. The powdered salt, dusted upon chancroids, has been found to promote rapid healing.

In hay fever a spray of cocaine, followed by a spray of quinine hydrochlorate (0.38 Gm. to 30 c.cm., or gr. vi-f℥j), used frequently, is highly recommended. A solution of quinine, sprayed into the throat, is attended with good results in diphtheria. Quinine has also been used as an injection in gonorrhœa for its antiseptic action.

In cystitis, irrigation of the bladder with a 2-per-cent. solution prevents decomposition of the urine. The hypodermic injection of quinine is of great value in pernicious malarial attacks and in sun-stroke. The best salts for this purpose are the neutral hydrochlorate, the hydrobromate, or the carbamid-hydrochlorate (hydrochlorate of quinine with urea). Injections have also been made directly into a vein, in order to obtain prompt results. Dr. J. R. Gilbert, of Dallas, Texas, suggests that life may be saved, in desperate cases of malarial poisoning, by injecting 2 Gm. (or ℥ss) of quinine into the circulation, administering cardiac stimulants by the mouth simultaneously. The solution should be freshly made and filtered and a perfectly-aseptic syringe used, as otherwise abscess or septicæmia, or even tetanus, may follow. The crystallized bisulphate may also be similarly employed. Freshly-precipitated quinine lactate, which is soluble in four times its weight of water, is well adapted to hypodermic use, giving rise to little pain. The crystallized salt, however, is soluble only in 16 to 20 parts of water.

As an ordinary tonic, in conditions of debility or convalescence, the tincture of the bark, either simple or compound (the latter being more astringent), is more useful than the alkaloids, for reasons already stated, and because the alcohol in the tincture is synergistic. In cases of diarrhœa the antiseptic action of cinchona is very valuable, and quinine is of service in typhoid fever, especially during the second week; but it does not approach the character of a specific, as it does in malarial attacks.

Some writers praise the action of quinine in summer diarrhœa and cholera morbus, and suggest that it would prove efficacious in Asiatic cholera. Professor Fullerton has strongly recommended its use in cholera, giving it in doses of 1 to 1.30 Gm. (or gr. xv-xx) in the course of two hours at the beginning of the attack. He values it likewise as a prophylactic remedy.

In ordinary chills and fever 1 Gm. (or gr. xv) daily of the sulphate, or bisulphate, or 0.75 Gm. (or gr. xij) of the hydrochlorate or hydrobromate, given in two or three doses, at least five hours before the time of the expected paroxysm, will generally prevent its appearance, or greatly modify it. The treatment should be continued for a week or ten days, diminishing the dose, or suspending it, if cinchonism appear, but resuming the full dose at septenary periods, after the appearance of the last chill, for a month or more. The following prescriptions may be used in malaria:—

℞ Quininæ sulphatis	8	Gm.	or 3ij.
Acidi sulphurici arom.	4	c.cm.	or f3j.
Ol. menth. pip.	30	c.cm.	or *mv*.
Fluidext. glycyrrhizæ	30	c.cm.	or f3j.
Glycerini	120	c.cm.	or f3iv.

M. Sig.: A teaspoonful or two every three or four hours.

℞ Quininæ sulphatis,			
Ferri pyrophos. aa	2 60	Gm.	or gr. xl.
Arsenii trioxidi	065	Gm.	or gr. j.
Pulveris capsici	1 30	Gm.	or gr. xx.
Aloini	13	Gm.	or gr. ij.

M. et ft. pil. no. xx.
Sig.: A pill three or four times a day.

℞ Tinct. cinchonæ comp.	120	c.cm.	or f3iv.
Tinct. nucis vomicæ	4	c.cm.	or f3j.
Fluidext. taraxaci,			
Fluidext. rhamnus purshianæ aa	60	c.cm.	or f3ij.

M. Sig.: A half to a tablespoonful in water three or four times a day.

A patient once poisoned by malaria may find it necessary to take a course of quinine for several weeks each year, at the season when the attack first appeared; and if unacclimated persons, wishing to stay in a malarious locality, or traveling through one at certain seasons of the year, will make use of the prophylactic action of quinine they may escape infection by taking from 0.25 to 0.38 Gm. (or gr. iv-vj) daily. In somewhat larger dose cinchonine is considered preferable to quinine for this purpose. In children, as well as in adults having a weak or irritable stomach, it is more convenient to administer the remedy in suppositories of cacao-butter, on account of the bitter taste and unpleasant effects on the digestion. The taste of quinine is tolerably well disguised by sweet or vanilla chocolate, or by coffee prepared with milk and sugar, the dose to be followed by a sip of coffee which contains no quinine. Ringer states that an equal portion of powdered ginger conceals the taste of quinine. Boiled or mashed potatoes will also re-

move the taste from the mouth. In enlargement of the spleen (ague-cake) quinine is very efficient. In intermittent fever it should not, as a rule, be given during the paroxysm, because its irritant action may increase the nervous disturbance; but in other fevers pyrexia is no contra-indication to its moderate use. In infectious diseases, hæmorrhagic measles, small-pox, diphtheria, and pyæmia, quinine, combined with alcohol, is the chief reliance.

This drug quite favorably influences the broncho-pneumonia of measles and counteracts the tendency to caseous degeneration. It is a serviceable remedy in children in lobular pneumonia dependent upon other causes. Combined with iron, quinine is very serviceable in erysipelas. Sixty-five cg. (or gr. x) of quinine, given with Dover's powder, opium, or morphine, are efficient in averting an attack of acute catarrh. The same quantity of quinine, given at the beginning, will sometimes abort acute tonsillitis and prevent the formation of pus. As quinine checks the principal phenomenon in inflammation and suppuration, which is the escape of the white blood-cell, and, by preventing the exchange of oxygen by the red blood-cells, reduces inflammation, it is especially serviceable in pneumonia and other localized inflammations, and also in reducing discharge from abscesses and preventing sapræmia or pyæmia. Bartholow considers that a larger dose (1.30 to 2.60 Gm., or gr. xx-xl) has the power, if administered during the congestive stage, before exudation has occurred, of suppressing or modifying a croupous pneumonia, pleurisy, or endocarditis.

In this country quinine is rarely, if ever, given in such large doses as it has been in Germany for the purpose of reducing high temperature in erysipelas, scarlatina, or rheumatism, although Liebermeister regards it as being a better antipyretic than the cold bath. It is not considered advisable to use such large amounts in typhoid, on account of the inflammation of the patches in the small intestine, quinine being a gastro-intestinal irritant. In typhoid and other fevers it may be administered in the following manner, especially if the action of the heart be weak:—

℞ Fluidextract. cinchonæ	22	c.cm. or f℥vj.
Tinct. cardamom. comp.	15	c.cm. or f℥iv.
Spiritus ætheris comp.	30	c.cm. or f℥j.
Tinct. digitalis	7.5	c.cm. or f℥ij.
Aquæ chloroformi	ad 300	c.cm. or f℥x.

M. Sig.: A half to a tablespoonful every three or four hours.

In whooping-cough, which is regarded by some as a parasitic infection, its use has been attended by much benefit in comparatively large doses, conjoined with the local use of a spray of quinine solution (Henke).

In many disorders of atonic character, such as neuralgia, dyspepsia, night-sweats of phthisis, general debility, neurasthenia, quinine is highly serviceable. It is particularly valuable in those manifestations of neuralgia which result from anæmia or malaria, and is well combined in the former case with iron, and in the latter with arsenic, thus:—

℞ Quininæ sulphatis,		
Massæ ferri carbonatis aa	2	Gm. or ℥ss.
Ext. nucis vomicæ	.20	Gm. or gr. iij.
Ext. belladonnæ folior.	.065	Gm. or gr. j.

M. et ft. pil. no. xij.
Sig.: A pill three or four times a day.

℞ Quininæ sulphatis ..... 4| Gm. or 3j.
Sodii arsenatis,
Ext. ignatiæ alc. ..... aa |13 Gm. or gr. ij.
M. et ft. pil. no. xx.
Sig.: A pill three times a day.

Dr. St. John Roosa has called attention to the dangers of quinine, on account of its causing serious disturbances of the ear, even when taken in small, though long-continued, doses. Professor Charcot, however, recommended the administration of quinine in Ménière's disease. His method was to give 0.38 Gm. (or gr. vj) twice daily, at meal-time, for fifteen days. The drug is then discontinued for eight days, when it is resumed in the same manner. The noises in the ear and the vertigo may be aggravated at first, but this effect soon subsides. Four or five such periods of alternate exhibition and discontinuance generally result in a cure. Many skin disorders and eruptions are due to malaria, in which quinine produces good effect, as pointed out by the late Dr. L. P. Yandell. In old malarial cases, the sulphate of cinchonine or cinchonidine may be substituted for the more expensive quinine salts:—

℞ Chloroformi ..... 2| c.cm. or *m*xxx.
Cinchonidinæ sulphas ..... 3|10 Gm. or gr. xlviij.
Tinct. cardamom. comp. ..... 7|5 c.cm. or f3ij.
Mucilaginis acaciæ .....q. s. ad 120| c.cm. or f3iv.
M. Sig.: Take a dessertspoonful every four hours for malarial toxæmia.

℞ Chinoidini ..... 4| Gm. or 3j.
Cinchonidinæ sulph. ..... 2|60 Gm. or gr. xl.
Piperinæ ..... |38 Gm. or gr. vj.
Cupri sulphat. ..... |13 Gm. or gr. ij.
M. et ft. pil. vel capsulæ no. xxx.
Sig.: One or two every three or four hours in severe malarial chills.

Other evidences of chronic malarial intoxication—as diarrhœa, dysentery, jaundice, and chorea—disappear under the administration of quinine. Intermittent hæmaturia, when due to this cause, is cured by the judicious administration of quinine. In view of its irritant effect upon the genito-urinary system, quinine will sometimes excite or aggravate hæmaturia in those suffering from malaria. This fact should be remembered in the management of malarial hæmaturia; in fact, it has been claimed that the hæmaturia is really produced by large doses of this drug administered in the treatment of the disease. Alexander Haig points out the fact that ordinary acid sulphate of quinine contains 20 per cent. of xanthin, which is physiologically and pathologically equivalent to uric acid, and which may therefore aid in the destruction of red blood-cells and liberation of hæmoglobin, which is the cause of black water. Small doses of quinine, temporarily employed, are useful in cases of catarrh of the stomach, whether due or not to alcoholic excess. Its action is aided by association with a mineral acid. Quinine is an excellent remedy in aphthous ulceration consecutive to enterocolitis, and in the yeasty vomiting produced by the growth of sarcina ventriculi. The same agent is of utility in the treatment of ascarides and tænia, not so much, perhaps, by virtue of a direct toxic influence upon the parasites, as correcting the unhealthy condition of the intestinal mucous membrane, which favors their development. Tonic doses of quinine render excellent service in delirium tremens. The laryngismus stridulus to which rickety children are

subject is ameliorated by quinine hydrobromide. This salt is preferred by Huchard[1] in the treatment of grip, in which he gives from 1 to 1.40 Gm. (or gr. xv-xxij) *per diem*, for the first few days, or:—

℞ Quininæ hydrobromidi,
Extracti ergotæ ..... aa |10 Gm. or gr. iss.
M. et ft. pil. Mitte tales no. xxx.
Sig.: Six to ten in the course of the day.

In many skin diseases dependent upon lowered nutrition,—as, for instance, acne, impetigo, or ecthyma,—small, daily doses of quinine are beneficial. This remedy is of value as a support to the system during the course of a prolonged suppuration; and a full dose is prudently given before the use of a catheter or bougie, in order to prevent the occurrence of a chill. It is an excellent tonic in bronchorrhœa. Good results have been claimed by certain French physicians from the use of quinine in acute rheumatism, but the experience of most observers is unable to confirm these reports. It is of more decided benefit in chronic rheumatism, especially when occurring in aged or debilitated subjects. In these cases it is best given in conjunction with the tincture of iron, or in the form of salicylate, or with potassium iodide:—

℞ Quininæ sulphatis ..... 4| Gm. or 3j.
Tinct. ferri chloridi ..... 30| c.cm. or f℥j.
Elix. gentianæ.....120| c.cm. or f℥iv.
M. Sig.: Two teaspoonfuls three or four times a day.

℞ Potassii iodidi ..... 27| Gm. or 3vij.
Spiritus chloroformi ..... 7|5 c.cm. or f3ij.
Tinct. cinchonæ comp. .....300| c.cm. or f℥x.
M. Sig.: A half to a tablespoonful in water three or four times a day.

Special Applications.—In obstetrics, quinine is valued as an oxytocic, increasing the energy of the uterine contractions, though not capable of inciting them. The late Dr. Ellerslie Wallace approved of quinine in uterine inertia during labor when it accompanies general muscular atony. In such cases it increases the expulsive force of the uterus and greatly reduces the danger from sepsis. Abortion has been produced by the administration of quinine and strychnine as a tonic, the accident being attributable to the latter agent. Quinine is also useful in aiding in preventing putrid infection from the uterine discharges, in the treatment of so-called milk-fever (a mild septicæmia) or milk-leg, and also in cases of uterine subinvolution after parturition. In small doses it stimulates the menstrual flow and acts as an emmenagogue. In anæmic patients, it may be given combined with iron:—

℞ Ferri et quininæ citratis ..... 4| Gm. or 3j.
Ol. tanaceti ..... |60 c.cm. or *m*x.
M. et div. in pil. no. xx.
Sig.: One four times daily, or two morning and night.

Warburg's tincture is highly prized in England in fevers, and in shock or collapse. Thirty c.cm. (or f℥j) contain 0.65 Gm. (or gr. x) of quinine, in combination with aromatics, half of this quantity being given at a dose and

[1] *Bulletin de l'Académie de Médecine*, Paris, Feb. 27, 1900.

the remainder in three or four hours.[1] Its administration is to be preceded by a brisk purgative. In severe cases of poisoning by malaria, large doses are absolutely necessary to save life when given by itself, but when given in the above combination much smaller quantities are found to answer the purpose.

Cinchonidine is useful in malaria. The *Therapeutische Wochenschrift* (Jan. 12, 1900) gives the following formula for internal use:—

℞ Cinchonidine sulph.	1	Gm. or gr. xv.
Acid. tartarici	75	Gm. or gr. xij.
Mist. acaciæ	120	c.cm. or ʒiv.

M. Take in the course of the day, in three or four doses.

For subcutaneous injections the formula is:—

℞ Cinchonidine sulph.	1	Gm. or gr. xv.
Acid. tartarici	80	Gm. or gr. xiij.
Aq. destill.	3	c.cm. or *m*xlv.

M. Each c.cm. of this solution contains 0.25 Gm. of cinchonidine. A daily dose of 1 Gm. (or gr. xv) cinchonidine by the mouth is usually sufficient, but 1.20 to 1.40 Gm. (or gr. xviii-xxij) can be taken without detriment.

Cinchonine Iodosulphate is the precipitate resulting from the addition of a solution of iodated potassium iodide (Bouchardat's reagent) to a watery solution of the cinchonine sulphate. It is collected and washed free from iodine, and dried. The resulting product is an amorphous, impalpable powder, of a brownish color, without odor, insoluble in water, though soluble in alcohol or chloroform. The dose of this preparation is from 0.065 to 0.32 Gm. (or gr. i-v). The interesting point in connection with it is that it contains 50 per cent. of iodine. M. Ivon[2] has recently completed some studies upon the antiseptic qualities, made with this agent, which, on account of its effects, he styles **Antiseptol,** and recommends as a substitute for iodoform on account of the low price and superiority as a surgical dressing.

Cinchonine iodosulphate, or antiseptol, has the action of the two substances that enter into its combination, being at the same time free from the toxic effect, which follows sometimes from the use of iodoform. Externally, it has been used by the writer for its antiseptic action with excellent results,

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[1] The National Formulary has the following formula for Warburg's tincture (without aloes), under the name of Tinctura Antiperiodica (N. F.):—

℞ Rhubarb, Angelica-seed, Elecampane, Saffron, Fennel, Gentian, Zedoary, Cubeb, Myrrh, White agaric, Camphor	aa 36	Gm. or ʒj av. gr. lxxxviii.
Quinine sulphate	100	Gm. or ʒiij av. gr. cxlviii.
Diluted alcohol	to make 5000	c.cm. or 10 pints.

This preparation, made without aloes, is intended to serve as a stock tincture from which regular Warburg's tincture is to be made, when required, by adding 1¾ per cent. of tincture of aloes, to the preceding formula. "Warburg's tincture without aloes" is often prescribed.

[2] *Le Progrès Médical,* July 12, 1890.

especially in the treatment of chronic ulcers, sinuses, abrasions, lupus vulgaris, abscesses, chronic acne, and various inflammatory thickenings of the integument. The following formulæ may be recommended:—

℞ Cinchoninæ iodosulphatis ..... 4| Gm. or 3j.
Ungt. zinci oxidi ..... 31| Gm. or ℥j.
M. For chronic acne, eczema, and psoriasis.

℞ Cinchoninæ iodosulphatis ..... 4| Gm. or 3j.
Ol. eucalypti ..... |60 c.cm. or *mx.*
Adipis lanæ hydrosi ..... 31| Gm. or ℥j.
M. For syphilis, chronic ulcers, and eczema.

Contra-indications to the use of quinine consist in:—

1. Idiosyncrasy, where severe tinnitus aurium, headache, skin eruptions, or purpura, are caused by small doses, and where this cannot be overcome by the use of bromides, ergot, or arsenic.

2. Acute inflammation of the genito-urinary tract, or congestion of the kidneys.

3. Acute inflammations of the gastro-intestinal tract.

4. Inflammation of the middle ear and dullness of hearing (nervous deafness).

5. Infants suffering with eczema.

It is stated on the authority of Brown-Séquard and Albertoni that quinine and cinchonidine increase the frequency of epileptic convulsions.

The comparative antiperiodic value of the alkaloids was thus estimated by Bartholow: "Quinidine is first as an antiperiodic; quinine comes next. Cinchonine requires about twice the dose in order to equal quinine. Cinchonidine is a little stronger than cinchonine. Amorphous chinoidine is about one-fourth the strength of quinine." In the United States army, the hydrochloride is generally given the preference over the sulphate on account of its greater solubility. The hydrobromide and valerianate are supposed to cause less nervous irritation in susceptible subjects than the other salts. The addition of a few drops of dilute sulphuric acid to quinine sulphate, when in solution, makes it much more soluble; or the bisulphate may be prescribed in pill form. The acid hydrochloride (B. P.) is useful for hypodermic injection; but contains one-tenth less of the alkaloid than the hydrochloride. The borate, carbolate, and salicylate have been introduced as especially serviceable in neuralgia. Quinine sulphovinate is a very soluble salt, requiring only twice its weight in water to dissolve it, and may be used hypodermically. M. Grimaux has recently succeeded in producing some new double salts of quinine, the hydrochlorosulphate, the hydriodosulphate, and the corresponding phosphates.

The hydrochlorosulphate is a granular, grayish-white, amorphous powder and has an extremely bitter taste, is soluble in its own weight of water, is equal in strength to the sulphate, than which it is more rapid in its action on account of being more readily absorbed. The physiological and therapeutical effects are the same as those of the sulphate. Its solubility renders it particularly serviceable for hypodermic use.

Cinchonamine, a new derivative of quinine, has been studied by M. Arnaud, who finds that it has as marked an effect and is more soluble than quinine. Cinchonamine is obtained from cuprea-bark. It is said to be six

times more toxic than quinine, is endowed with only slight antiseptic power; but reduces abnormal temperature, and may be serviceable in malaria. It is said to exert a decided sialogogic influence.

Clinical experiments with the salts of the synthetical alkaloids have been carried on by Professor Bourru, of Rochefort. The hydrochloride of cupreine is efficient in malaria, but must be given from the beginning in doses of 1 to 2 Gm. (or gr. xv-xxx). This salt produced no ill effects. It was without influence upon the pulse. The sulphate of quinethyline appears to be superior as an antiperiodic to quinine. It was employed in maximum doses of 0.75 Gm. (or gr. xij). The sulphate of quinopropyline is the most energetic member of the series. In a case of typhoid fever it produced a marked reduction of temperature. A dose of 0.50 Gm. (or gr. viij) gave rise to buzzing in the ears, vertigo, nausea, and general malaise. It is active in about half the dose of quinine.[1]

Quininæ Tannas.—The tannate is sometimes called "tasteless quinine," because the bitterness is almost entirely overcome by the combination, and, also, largely because of insolubility of the salt. Although insoluble in water, it is soluble in the acid gastric juice, and when administered with food, or soon afterward, it answers equally well with the other salts. In the combination with sweet chocolate, all objectionable taste is overcome, and, made into troches, or compressed tablets, each containing 0.065 Gm. (or gr. j), we have a sort of confection: probably the very best form in which to administer quinine to children. It may be made extemporaneously:—

℞ Quininæ ..... 1|55 Gm. or gr. xxiv.
Acidi tannici ..... |75 Gm. or gr. xij.
Syrupi cinnamomi ..... 90| c.cm. or f℥iij.

M. Each teaspoonful contains 0.065 Gm. (or gr. j) of quinine. If the quinine sulphate is used, the tannic acid must be doubled.

℞ Quininæ hydrochloridi ..... 1|55 Gm. or gr. xxiv.
Acidi tannici,
Glycyrrhizin. ammoniat. ..... aa |75 Gm. or gr. xij.

M. et div. in chartulæ no. xij.
Sig.: Three daily.

Regarding the method of administration of this very bitter agent, several devices are adopted to enable patients to take it, among the best of them is the gelatin- or sugar- coated pill, the hard capsule, *cachêts de pain*, or conseals. The following mixture is an agreeable method of administration in solution:—

℞ Quininæ sulphatis ..... |13 Gm. or gr. ij.
Acid. citric. ..... |38 Gm. or gr. vj
Syrupi aurantii florum ..... 4| c.cm. or f3j.—M.

This is to be placed in a wine-glass containing sodium bicarbonate, 0.20 to 0.32 Gm. (or gr. iii-v), in saturated solution, and then drunk during effervescence. The National Formulary provides a good vehicle in compound taraxacum elixir:—

℞ Quininæ sulphatis ..... 1|55 Gm. or gr. xxiv.
Elixir taraxaci comp. (N. F.) ..... 90| c.cm. or f℥iij.

M. Sig.: A teaspoonful to a tablespoonful, according to circumstances.

[1] *La Tribune Médicale*, July 5, 1894; *The Medical Bulletin*, Sept., 1894, p. 349.

An adult can take a powder of quinine in a dessertspoonful of syrup of red orange, or syrup of wild cherry, without experiencing much unpleasant taste. Some prefer to take it in a little whisky and water. Other preparations which may be used with more or less success in order to disguise the taste of quinine are cascara cordial and the aromatic syrup of yerba santa. When given in powder, quinine may be rendered nearly tasteless by rubbing up with one-fourth its weight of ammoniated glycyrrhizin. The ammoniated elixir of glycyrrhizin is also a good excipient for the sulphate, which is suspended in the mixture. No acid should be added when the extract is used. The sugar-coated or gelatin-coated pills are most commonly used, and, if properly made (and if they contain the full amount of the drug), they answer, if not too dry and hard. In cases of irritability of the stomach and diarrhœa it is better to use the drug in the form of a solution. Cinchonine sulphate may be serviceably employed instead of quinine, especially in the treatment of children. Cinchonine is effectual in malaria and does not occasion buzzing in the ears, though it gives rise to a sensation of dryness in the nose and mouth and may cause paresis of acommodation with alteration in the size of the pupil.

The tannate of quinidine is also almost tasteless and may be used with advantage in dyspepsia, diarrhœa, and nephritis.

Euquinine.—By the action of ethyl-chlorocarbonate on quinine, according to von Noorden,[1] quinine carbonic ether is formed, which possesses the curative properties of quinine without its bitterness, or producing nausea, noises in the ears, depression of spirits, etc. It has been therefore called **Euquinine.** It is a crystallizable substance, sparingly soluble in water, but readily soluble in alcohol, ether, or chloroform. The chloride of Euquinine, however, is easily soluble in water. Euquinine may be given in sherry-wine, milk, or coca. The dose is 0.12 to 1 Gm. (or gr. ij-xv), which in healthy people produces no effect. Beneficial results have been reported in febrile states and in whooping-cough. It reduces temperature in pyrexia. In supra-orbital neuralgia, the effects were especially good. It is given usually in powder form. St. George Gray,[2] of St. Lucia, West Indies, has found very good results in malarial fevers. He denies the statement made by others that it will not cause cinchonism, as he had experienced tinnitus aurium, deafness, and other phenomena, just as from quinine. He considers it a more powerful antipyretic and antimalarial agent than quinine itself.

CINNAMOMUM (U. S. P.).—**Cinnamon.**—Two kinds of cinnamon are officially recognized by the United States Pharmacopœia: Cinnamomum Saigonicum (U. S. P.), Saigon Cinnamon, the dried bark of an undetermined species of Cinnamomum (Lauraceæ), and Cinnamomum Zeylanicum (U. S. P.), Ceylon Cinnamon, the inner bark of the shoots of Cinnamomum zeylanicum (Lauraceæ).

CINNAMOMI CORTEX (B. P.). — **Cinnamon-bark.** The dried inner bark of shoots from the truncated stocks of Cinnamomum zeylanicum. Obtained from cultivated trees. Imported from Ceylon and distinguished in commerce as *Ceylon cinnamon.*

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[1] *Centralblatt für innere Medicin*, Nov. 28, 1897.
[2] *The British Medical Journal*, Feb. 26, 1898, p. 551.

Preparations.

Pulvis Aromaticus (U. S. P.).—Aromatic Powder (cinnamon, ginger, aa 35 parts; cardamom and nutmeg, aa 15 parts). Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Fluidextractum Aromaticum (U. S. P.).—Aromatic Fluid Extract (aromatic powder exhausted with alcohol, 1 Gm. = 1 c.cm.). Dose, 1 to 4 c.cm. (or *m*xv-f3j).

Oleum Cinnamomi (U. S. P., B. P.).—Oil of Cinnamon, Oil of Cassia. Dose, 0.06 to 0.18 c.cm. (or *m*i-iij).

Cinnaldehydum (U. S. P.).—Cinnamic Aldehyde (obtained from oil of cinnamon, or prepared synthetically, contains not less than 95 per cent. of pure cinnamic aldehyde). Dose, about the same as the oil.

Tinctura Cinnamomi (U. S. P., B. P.).—Tincture of Cinnamon. Dose, 4 to 15 c.cm. (or f3i-iv). B. P., 2 to 4 c.cm. (or f3ss-j).

Aqua Cinnamomi (U. S. P., B. P.).—Cinnamon-water. Dose, 15 to 120 c.cm. (or f3ss-iv).

Spiritus Cinnamomi (U. S. P., B. P.).—Spirit of Cinnamon (10 per cent. of oil). Dose, 0.06 to 4 c.cm. (or *m*x-f3j). B. P., 0.30 to 1.20 c.cm. (or *m*v-xx).

Pulvis Cinnamomi Compositus (B. P.).—Compound Powder of Cinnamon (cinnamon, cardamom, and ginger, equal parts). Dose, 0.65 to 2.60 Gm. (or gr. x-xl).

Syrupus Aromaticus (B. P.).—Aromatic Syrup (tincture of orange and cinnamon-water, each, 250 c.cm.; syrup, 500 c.cm.). Dose, 2 to 4 c.cm. (or f3ss-j).

The following U. S. P. preparations contain cinnamon as a constituent: Aromatic sulphuric acid, compound tincture of catechu, compound tincture of lavender, syrup of rhubarb, aromatic tincture of rhubarb, aromatic syrup of rhubarb, compound tincture of cardamom, chalk mixture, and wine of opium.

(For **Cinnamic Acid** see **Styrax.**)

Pharmacology.—Cinnamon is the inner bark of the shoots of Cinnamomum zeylanicum (Ceylon cinnamon), or the bark of an undetermined species of Cinnamomum (Saigon cinnamon). The bark of several undetermined species of Cinnamomum grown in China (Cinnamomum cassia, Cassia cinnamon, or Chinese cinnamon) is also used, but is not now official. The British Pharmacopœia specifies the source as cultivated trees from Ceylon. Besides the volatile oil, which is used for flavoring purposes, cinnamon contains tannic acid, mucilage, coloring matter, an acid, and lignin. The oil consists almost entirely of cinnaldehyde.

The Ceylon cinnamon is the choice variety, but the greater portion of this valued spice brought to this country is the cassia cinnamon, the flavor of which is less sweet and more pungent and astringent. The physiological properties are the same.

Physiological Action. — Cinnamon is an aromatic, with considerable astringency. It acts as an hæmostatic, not so much through its astringent constituents as by virtue of the volatile oil, which may be used efficiently alone.

Therapy.—In cases, especially among children, where counter-irritation is needed, the use of spice plasters is recommended, as in croup, colic, neuralgia, etc. They can be obtained already prepared for use, or may be prepared extemporaneously by placing aromatic powder between two layers of flannel and moistening it with hot whisky. As a stomachic, in flatulence and feeble digestion, cinnamon is of some value, but its carminative effect is most frequently utilized in combination with other remedies, especially purgatives, to prevent griping. It is of service in diarrhœa, as in the chalk mixture, to which other agents may be added:—

℞ Bismuthi salicylat. ..... |065 to |20 Gm. or gr. i-iij.
Misturæ cretæ ..... 4| c.cm. or f3j.

M. pro dosi.

For irritative diarrhœa of infants, especially summer diarrhœa, this dose to be repeated according to urgency every hour or more.

Finely-powdered cinnamon, given in doses of 4 to 6 Gm. (or 3i-iss), morning and evening, is said to be an efficient remedy in acute dysentery. It will at times be found capable of allaying nausea and vomiting, or even of relieving seasickness. In passive uterine hæmorrhage we may give an extemporaneous infusion in milk, or give the oil upon sugar. The oil may also be utilized, at least as an adjuvant, in pulmonary hæmorrhage.

Dr. J. C. Ross claims that large doses of cinnamon, internally administered, are of value in the palliative treatment of carcinoma of various internal organs. He states that pain is alleviated, the odor decreased, and the general condition improved. Dr. Ross directs that from 11 to 13 ounces of Ceylon cinnamon be placed in 3 quarts of water, boiled down to a quart, and decanted without filtering. Of the mixture a pint is to be taken every twenty-four hours.

Various vegetable essences have been shown by M. Chamberland to possess very marked antiseptic power. The oil of cinnamon has been utilized by M. Lucas-Championnière as a surgical dressing. Employed in full strength it is very irritant, but dissolved in retinol to form a pomade it constitutes an excellent application to sutured wounds after operations. Dr. J. Chalmers Da Costa, of Philadelphia, recommends the oil of cinnamon as an injection in gonorrhœa. He first cleanses the urethra by diluted hydrogen dioxide, after which he injects the oil of cinnamon dissolved in one of the liquid-petroleum preparations. The solution is made of the strength of 0.06 c.cm. to 30 c.cm. (or *m*i-f℥j) on the first day, 0.12 c.cm. to 30 c.cm. (or *m*ii-f℥j) on the second day, and thenceforward 0.18 c.cm. (or *m*iij) to the same quantity of menstruum. Inhalation of a spray containing the spirit of cinnamon is said by Dr. Capsus to be of decided service in all forms of malaria, cases which had proved unamenable to quinine and arsenic improving within a few days. The following are useful formulæ for antiseptic ointments:—

℞ Retinol.	70	Gm.	or ℥ii3ij.
Ceræ sterilizat.	23|4	Gm.	or 3vj.
Cinnaldehydi	1	c.cm.	or *m*xv.

℞ Retinol.	70	Gm.	or ℥ii3ij.
Ceræ sterilizat.	23|4	Gm.	or 3vj.
Cinnaldehydi	1	c.cm.	or *m*xv.
Betanaphthol	1	Gm.	or gr. xv.—M.

℞ Retinol. et ceræ	93|3	Gm.	or ℥iij.
Olei cinnamomi	1	c.cm.	or *m*xv.
Olei origani,			
Olei geranii aa	2|50	c.cm.	or *m*xl.
Olei verbenæ	2	c.cm.	or *m*xxx.—M.

℞ Retinol. et ceræ	93|3	Gm.	or ℥iij.
Olei Cinnamomi,			
Olei origani,			
Olei thymi,			
Olei verbenæ aa	1|55	c.cm.	or *m*xxv.—M.

J. Hilton Thompson claims that the oil of cinnamon is of great value in the treatment of pulmonary tuberculosis when administered by inhalation. The patients like the odor of the oil, and will wear the inhaler almost continuously. In addition he gives tonic remedies, and continues the treatment for months. Under this method of administration the bacilli become less

numerous and all the symptoms improve. Several cases showing marked benefit are reported.[1]

COCA (U. S. P.).—**Coca.**

COCÆ FOLIA (B. P.).—**Coca-leaves.**

Preparations.

Fluidextractum Cocæ (U. S. P.).—Fluid Extract of Coca. Dose, 0.60 to 4 c.cm. (or *m*x-f3j).

Cocainæ Hydrochloridum (U. S. P., B. P.).—Cocaine Hydrochloride. Dose, 0.015 to 0.065 Gm. (or gr. $^1/_4$-j).

Extractum Cocæ Liquidum (B. P.).—Liquid Extract of Coca. Dose, 2 to 4 c.cm. (or f3ss-j).

Cocaina (U. S. P., B. P.).—Cocaine. Dose, 0.015 to 0.03 Gm. (or gr. $^1/_4$ to $^1/_2$).

Oleatum Cocainæ (U. S. P.).—Oleate of Cocaine (contains 5 per cent. of cocaine oleate in olive oil). Used as a local anæsthetic.

Vinum Cocæ (U. S. P.).—Wine of Coca (contains fluid extract of coca, $6^1/_2$ per cent., in red wine). Dose, 30 to 60 c.cm. (or f3j-ij).

Unguentum Cocainæ (B. P.).—Ointment of Cocaine (4 per cent.).

Lamellæ Cocainæ (B. P.).—Discs of Cocaine (each contains, of cocaine hydrochloride, 0.0013 Gm., or gr. $^1/_{50}$).

Injectio Cocainæ Hypodermica (B. P.).—Hypodermic Injection of Cocaine (10 per cent.). Dose, by subcutaneous injection, 0.12 to 0.30 c.cm. (or *m*ii-v).

Trochiscus Krameriæ et Cocainæ (B. P.).—Krameria and Cocaine Lozenge (contains of krameria extract, 0.065 Gm., or gr. j; cocaine hydrochloride, 0.003 Gm., or gr. $^1/_{20}$).

Pharmacology.—Cocoa is the dried leaves of Erythroxylon Coca, Lamarck (Erythroxyloneæ), a small tree of Peru and Bolivia, known commercially as Huanuco coca, or of E. Truxillense (Rusby), known commercially as Truxillo coca, yielding, when assayed by official process, not less than 0.5 per cent. of the ether-soluble alkaloids of coca. It contains a crystallizable alkaloid, **Cocaine** (which has been ascertained by Lossen to be methyl-benzoyl-ecgonine), besides other alkaloidal derivatives of ecgonine. It also contains wax, **Coca-tannic acid,** and a concrete, volatile, odorous substance. **Tropacocaine,** an analogous alkaloidal compound, has been found by Giesel in the small-leaved coca-plant of Java. It is probable that the fresh leaves contain a volatile principle of considerable physiological activity, which is lost after a sea-voyage, by partial fermentation and drying, as maintained by Dr. H. H. Rusby. They also contain coca-tannic acid and some oil, aromatic and coloring matters, etc.; but cocaine, after all, is the most important constituent. As cocaine is decomposed into benzoic acid and ecgonine by the action of mineral acids, these should not be prescribed with the fluid preparations made from coca-leaves. A precipitate also results from a mixture of the solutions of sodium bromide and cocaine hydrochloride. The salts of cocaine are incompatible with those of mercury. A mixture of cocaine and menthol is said to form a very irritant combination. Cocaine and silver nitrate are incompatible.

Physiological Action.—Coca and to a marked degree cocaine cause local numbness or anæsthesia when applied to mucous membranes and when injected hypodermically. When cocaine is applied to the conjunctivæ, sensibility is reduced, the pupils become dilated, and the accommodation impaired; it constricts the blood-vessels, diminishes the intra-ocular tension,

[1] *British Medical Journal*, Nov. 7, 1896, p. 1374.

causes enlargement of the palpebral fissure and protrusion of the eyeball. It occasions an irregularity of the corneal surface, or haziness, which does not appear, however, to depend upon loss of epithelium. When applied to the tongue, it causes numbness and loss of tactile sensibility without affecting the movements. The application of cocaine to the pharynx, or larynx, and nasal chambers, reduces the sensibility so as to permit manipulation or operation, and also by its effect upon blood-vessels reduces congestion and inflammation. Taken in small doses frequently repeated, coca acts as a general tonic and prevents waste. In somewhat larger doses it is a nerve-stimulant, increasing the blood-supply to the nerve-centres, improves the digestive powers, increases the force of the heart's action and arterial tension by its influence upon the vasomotor centres and cardiomotor ganglia. It also gives a sense of well-being that enables the organism to bear more fatigue and to sustain the powers of the body with less food or less sleep than usual. Coca increases the flow of urine, but the quantity of urea is lessened; it thus acts as an indirect food by preventing waste. After an overdose the pulse becomes rapid and weak, respiration is labored and shallow, and oppression of the chest is complained of, with threatening collapse, clammy skin, hallucinations, and delirium. Clonic convulsions of cerebral origin are occasioned and the bodily temperature markedly increased. Death is due to the paralysis of the heart, the spinal centres, or the centres in the medulla. Diarrhœa is produced by large doses, with headache (Hammond). According to the studies of M. Maurel, coca has an action upon the leucocytes, causing them to become globular and rigid and to lose their property of adhering to the walls of the vessels. In this manner thrombi and emboli are formed and death is apt to result from pulmonary embolism. Gley has experimentally determined that the liver diminishes the toxicity of cocaine. In some cases of poisoning from cocaine, albumin has been found in the urine.

Poisoning.—The treatment is the same, generally speaking, as for toxic doses of caffeine. Morphine, atropine, chloral-hydrate, paraldehyde, sulphonmethane, amyl nitrite, chloroform, alcohol, and ether are physiological antidotes. Strophanthin, or strychnine, may be given hypodermically, for heart weakness.

Ammonia and digitalis may likewise be made use of in order to counteract the milder toxic manifestations of cocaine. In severe cases Dr. S. Mitchell has employed with service a large teacupful of clear coffee, which can be administered cold or hot.[1] In some cases toxic effects have apparently been produced, with great depression and imminent collapse, by extremely minute doses, as where cocaine is used as a mydriatic, or applied to the throat, nose, or urethra. They can only be explained by idiosyncrasy, and the symptoms usually promptly disappear after the administration of stimulants, or the inhalation of ammonia or ether. A form of protracted acute cocainism has been lately described by Hallopeau, who has, in several instances, observed the injection of a single small dose to produce distressing symptoms, which may endure for several months. The symptoms bear much resemblance to those which immediately follow the injection, and consist, above all, of persistent headache, accompanied by profound malaise, insomnia, numbness of the limbs, vertigo, syncope, mental excitement, and loquacity.[2] It occasionally happens that the application of cocaine solution to

[1] *Western Medical Reporter*, Sept., 1892.

[2] *La Tribune Médicale*, Dec. 4, 1890; *Medical Bulletin*, Jan., 1891.

certain portions of the mucous membrane is followed by great muscular relaxation, a weak pulse, dysphagia, and pharyngeal paralysis without loss of consciousness. This condition has terminated fatally in a few cases when the amount of drug absorbed could have been only a fraction of a grain, and, therefore, the result was in some manner caused by reflex action and possibly was partly psychical in its nature. The parts most susceptible to the action of cocaine appear to be the middle turbinate bone and upper fossa of the nose, and the male urethra. A case of serious poisoning following the injection of cocaine solution into the urethra for dilatation of a stricture is reported by Brennan,[1] when morphine, nitroglycerin, and ammonia were used as antidotes with success. Magnan has called attention[2] to a peculiar disorder of sensation attending chronic cocaine poisoning. It is a feeling as of foreign bodies, grains of sand, worms, or microbes under the skin in any part of the body. This has been called Magnan's symptom. There is a generally recognized danger of forming the cocaine habit, and examples are not wanting of unfortunate cases of this kind among members of the medical profession. **Cocainism,** the result of constant use of this drug as a stimulant, is met with, especially among neurotics and degenerates; possibly the addiction may be, in some cases at least, the first manifestation of insanity. In a large number of cases, moreover, those who fall victims to the cocaine habit are also addicted to the use of morphine, the double intoxication leading to the most serious deterioration of health. Appetite and strength decrease, tremors and hallucinations occur, and insanity may finally supervene. Medicinally, cocaine addiction is most successfully treated by large doses of chloral-hydrate, or potassium bromide in combination with chloral. Cocaine is eliminated by the kidneys, much of it, however, being oxidized within the system.

Therapy.—The introduction of cocaine as a local anæsthetic is due to Dr. Koller, who first called attention to its usefulness in eye-surgery in 1884. Its influence in causing local anæmia and dilatation of the pupil having been discovered, it has become one of the necessary drugs in eye-practice (a 4-per-cent. solution being the usual strength employed, as first recommended by Koller). Anæsthesia of the conjunctiva results in from one to five minutes after instillation of cocaine. The completed dilatation of the pupil does not occur until ten or twenty minutes after the instillation; it continues for about an hour, and then gradually disappears. Though impaired, the accommodation is not entirely paralyzed, and it returns even while the pupils remain dilated. The conditions of the eye in which cocaine is particularly applicable are diseases of the conjunctiva and cornea, accompanied by pain and photophobia. By its local anæsthetic properties it facilitates many of the operations upon the eye. The removal of foreign bodies imbedded in the cornea, the excision of pterygium, the cauterization of corneal ulcers, dilatation of the lacrymal canal; the operation for strabismus, staphyloma, or chalazion; iridectomy, and extraction of the lens are now all accomplished by the aid of cocaine anæsthesia. When used too freely, it produces a steamy condition of the cornea.

According to Dr. Arthur G. Hobbs, of Atlanta,[3] cocaine should never be

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[1] *New York Medical Journal*, Nov. 19, 1898.

[2] *Münchener medicinische Wochenschrift*, 1896, p. 1175.

[3] "The Uses and Abuses of Cocaine, with Reference to Mucous Membranes Especially." *The Southern Medical Record*, Nov., 1892.

used when an abrasion of the cornea exists. He regards it as contra-indicated also in any corneal inflammation, and thinks that it should not be prescribed beyond the acute stage of any form of conjunctivitis. It is not so well adapted for use when enucleation of the eyeball is to be performed, though this operation may be done when the alkaloidal solution is injected deeply around the orbit. Mr. Leahy has found cocaine serviceable in gonorrhœal ophthalmia. He incorporates 0.03 Gm. (or gr. ss) of atropine sulphate and 0.25 Gm. (or gr. iv) of cocaine sulphate in 6.50 Gm. (or gr. c) of petrolatum (oleic acid or lanolin is perhaps a better vehicle to favor the absorption of the drugs incorporated), and applies the mixture beneath the upper lids. Dr. P. Richard Taylor, of Louisville, esteems cocaine as superior to the mydriatics usually employed in the treatment of iritis. He advises its use in a concentrated form, as its effects in contracting the vessels limit its absorption. He is accustomed to employ a 25-per-cent. watery solution, or an ointment composed of 25 parts of cocaine to 100 parts of petrolatum. The tablets or discoids of cocaine now supplied by manufacturers are useful in making extemporaneous and perfectly sterile solutions of any desired strength.

In aural surgery, a solution of cocaine may be introduced within the auditory canal for the relief of acute and chronic purulent otitis, ulcers of the canal, or to facilitate operative procedures within the tympanic cavity. Albert Gray, previous to paracentesis of the membrana tympani, uses a 5- or 10-per-cent. solution, in equal parts of alcohol and anilin oil. Cocaine applied to the lower nasal passages and the orifice of the Eustachian tube is a valuable assistance in catheterization of the tube through the nose. Dr. Ticano has reported a case in which a few drops of a 5-per-cent. solution of cocaine introduced through a catheter into the middle ear soon excited vomiting and diarrhœa, which continued for several hours. By application of this remedy to the mouth of the tube, the inflation and injection of remedial liquids into the tube and the middle ear are rendered much easier of performance. Bonain's local anæsthesia comprises the anæsthesia of the external surface of the tympanic membrane with a mixture of phenol, menthol, and cocaine hydrochloride, aa 1 Gm. (or gr. xv) ; or 2 Gm. (or ʒss) of the phenol to 0.5 or 1 Gm. (or gr. viiss-xv) of the other ingredients. The internal surface of the membrane and the mucosa of the tympanum are anæsthetized with 2 or 3 drops of a one-tenth solution of cocaine, instilled, through an incision or incisions made in the membrane, with a Hartman cannula, mounted on a small syringe.

In chronic laryngeal tuberculosis, Professor Moure makes use of the following combination applied by means of an atomizer:—

℞ Cocain. hydrochlorid.		25	to	65	Gm. or gr. iv-x.
Chlorali hydrati,					
Potass. bromid.	aa	2	to	3	Gm. or gr. xxx-xlv.
Glycerin.				45	c.cm. or fʒiss.
Aq. destillat.				180	c.cm. or fʒvj.

M. ft. sol.

Sig.: To be used three or four times a day, from three to five minutes on each occasion.

In dental and nasal surgery, this substance fulfills numerous indications. The local anæsthesia produced by cocaine permits operation for ingrown nails and the removal of intralaryngeal tumors.

Cocaine is best applied on a compress, or in wafers with gelatin, in the throat or nose, for simple catarrh, pharyngitis, laryngitis, and for the relief of hay fever (4- to 20-per-cent. solution). Dr. Isidore Gluck avoids the toxic effect that sometimes ensues by using the following local application:—

℞ Phenolis liquefact.		12 c.cm. or *m*ij.
Aquæ destill.	4	c.cm. or f3j.
M et adde:—		
Cocainæ hydrochloridi		65 Gm. or gr. x.

M. Phenol renders the solution aseptic and increases the analgesic effect of the cocaine.

A chemical combination, cocaine phenate, has been more recently introduced, and has been employed with advantage in most of the conditions where the hydrochloride has proved useful. Cocaine phenate is a yellowish substance, of the consistency of honey. It melts readily when heated. It is soluble in alcohol. The dose is from 0.005 to 0.01 Gm. (or gr. $^1/_{12}$-$^1/_6$). It may be applied locally in solutions varying in strength from 1 to 10 per cent. When placed upon the tongue it obtunds both taste and tactile sensibility. It produces profound anæsthesia of the conjunctiva, with dilatation of the pupil, partial paralysis of accommodation, slight lacrymation, and often temporary ptosis. Anæsthesia is of rather slower development than from the use of the hydrochloride, but is of longer duration. The phenate, also, is much less apt to be absorbed and produce systemic effects. Cocaine phenate has been used in operations upon the throat and nose with advantage by Dr. D. B. Kyle.[1]

Good results have likewise been reported from the use of this salt by Dr. C. A. Veasey and by German observers.

The following combinations are recommended[2]:—

℞ Cocain. phenat.		10 Gm. or gr. iss.
Menthol.		25 Gm. or gr. iv.
Alcohol. dilut.	9	25 c.cm. or f3iiss.

M. Sig.: For inhalation in diseases of the larynx and bronchial tubes.

℞ Cocain. phenat.		20 Gm. or gr. iij.
Pulveris acidi borici	2	Gm. or gr. xxx.

M. Sig.: For insufflation in rhinitis and chronic nasal catarrh.

Parker advocates a combination with resorcin, in order to overcome the unpleasant or toxic effects which sometimes follow the application of strong solutions of cocaine to the nose or throat. The association of these drugs seems to add to the antiseptic and astringent action of the cocaine. Dr. Gauthier is accustomed to conjoin with the cocaine solution prepared for injection 1 drop of a 1-per-cent. solution of nitroglycerin, or the official spirit of glyceryl nitrate. In this manner he aims to antagonize the influence of the cocaine upon the cerebral blood-vessels. Bignor asserts that acid solutions produce but little anæsthetic effect, and advises that the ordinary solutions should be rendered neutral. When an excess of sodium carbonate is added to such a solution, the alkaloid is liberated and forms a

[1] "Phenate or Carbolate of Cocaine as a Local Anæsthetic." *Therapeutic Gazette*, Jan. 16, 1893.

[2] *Journal de Médecine de Paris.*

finely-divided mixture. He terms this suspension "milk of cocaine," and states that, when freshly made, it produces an excellent anæsthetic effect.

Dr. John Edwin Rhodes, of Chicago, makes use of a combination, which he thinks intensifies the anæsthetic property of cocaine and perhaps hastens the anæsthesia. His formula is as follows:—

℞ Atropin. sulphatis		.03	Gm. or gr. ss.
Strophanthini		.012	Gm. or gr. $^1/_5$.
Cocain. hydrochloridi	1	.30	Gm. or gr. xx.
Phenolis liquefact.		.32	Gm. or gr. v.
Aq. destillat. q. s. ad	30		c.cm. or f℥j.

M. For hypodermic use.

This solution has, injected in doses of 0.12 to 0.50 c.cm. (or *m*ii-viij), produced almost complete local anæsthesia without constitutional disturbance. It has also been used by means of an atomizer in the pharynx, larynx, and nasal cavity.

Professor Schleich has devised a method of producing local anæsthesia for surgical operations by marking out the line of incision by a succession of intradermic injections of weak solutions of cocaine and morphine.

The following are the formulæ for the solutions used by Schleich for producing local anæsthesia:—

No. 1. Strong:—

℞ Cocainæ hydrochloridi		2	Gm. or gr. iij.
Morphinæ hydrochloridi		.025	Gm. or gr. $^2/_5$.
Sodii chloridi (sterilized)		2	Gm. or gr. iij.
Aquæ destillatæ (sterilized), q. s. ad	100		c.cm. or f℥iii℥iiss.—M.

No. 2. Normal:—

℞ Cocainæ hydrochloridi		1	Gm. or gr. iss.
Morphinæ hydrochloridi		.025	Gm. or gr. $^2/_5$.
Sodii chloridi (sterilized)		2	Gm. or gr. iij.
Aquæ destillatæ (sterilized) q. s. ad	100		c.cm. or f℥iiif℥iiss.—M.

No. 3. Weak:—

℞ Cocainæ hydrochloridi		.01	Gm. or gr. $^1/_6$.
Morphinæ hydrochloridi		.005	Gm. or gr. $^1/_{12}$.
Sodii chloridi (sterilized)		2	Gm. or gr. iij.
Aquæ destillatæ (sterilized) q. s. ad	100		c.cm. or f℥iiif℥iiss.—M.

One drop of a 40-per-cent. solution of formalin should be added to each of these solutions to preserve them. The fluid is injected in such a manner that the part to be operated upon is completely surrounded by wheals of the injected fluid. These wheals may be carried into the deep tissues. The area for the primary needle puncture may be anæsthetized by a drop of 95-per-cent. solution of carbolic acid.

In order to avoid throwing the cocaine into a vein, Magitot advises that it be injected into the substance of and not beneath the skin or mucous membrane. Except in the case of operations upon the head, the patient should be in a recumbent position when the injection is made. The dose should be in proportion to the extent of surface to be anæsthetized, but should never exceed 0.08 to 0.10 Gm. (or gr. i $^1/_4$-iss). It is well to divide the dose into several portions, leaving an interval of several minutes between each injection. If toxic manifestations follow the first portion, further injection must be abandoned.

Bagot[1] combines sparteine with cocaine, which obviates the depressing effect of the cocaine on the heart, while rendering the anæsthesia more lasting. He has a powder prepared beforehand: cocaine hydrochloride, 0.036 Gm. (or gr. $^3/_5$), and sparteine sulphate, 0.048 Gm. (or gr. $^3/_4$). When ready to use, the powder is dissolved in 1 or 2 c.cm. (or *m*xv-xxx) of boiled water. As much as 8 to 12 cg. (or gr. i $^1/_4$-i $^3/_4$) of cocaine can thus be injected, in fractional injections, without accident. In operating on a tumor, he injects 1 c.cm. (or *m*xv) of the weaker solution on one side, and waits seven or eight minutes before injecting the other side. He can then commence the operation in a few minutes on the side first injected. If the operation requires over twenty minutes, a third injection can be made, which keeps up the anæsthesia for three-quarters of an hour.

An ointment or solution of cocaine has been employed for the purpose of relieving the pain of cracked nipples, but it has been found to have the further effect of diminishing the secretion of the milk. For the suppression of lactation, Dr. Joire, of Lille, recommends the application of a solution of 1 Gm. (or gr. xv) of cocaine in 9.50 c.cm. (or f3iiss) each of water and glycerin.

An ointment containing coca or cocaine hydrochloride is an admirable local remedy in affections characterized by severe pain or distressing itching. The extract of coca (2 to 4 Gm., cr gr. xxx-3j) may be incorporated in 31 Gm. (or ℥j) of lard, or the salt of the alkaloid may be used in the proportion of 0.25 to 0.50 or 0.65 Gm. (or gr. iv-viii or x) to 31 Gm. (or ℥j), or as follows:—

℞ Extracti cocæ	2		Gm. or 3ss.
Creosoti		30	c.cm. or *m*v.
Ungt. zinci oxidi	31		Gm. or ℥j.
Ungt. plumbi subacetatis	15	5	Gm. or ℥ss.

M. For subacute eczema or psoriasis.

℞ Cocainæ hydrochloridi		65	Gm. or gr. x.
Plumbi carbonatis	4		Gm. or 3j.
Pulveris marantæ	4		Gm. or 3j.
Ol. eucalypti		24	c.cm. or *m*iv.
Ungt. zinci oxidi	31		Gm. or ℥j.

M. Useful in acute eczema, dermatitis, burns, and irritable ulcers.

℞ Cocainæ hydrochloridi		75	Gm. or gr. xij.
Atropinæ sulphatis		065	Gm. or gr. j.
Phenol liq.		30	c.cm. or *m*v.
Ol. anthemidis		24	c.cm. or *m*iv.
Ungt. zinci oxidi	31		Gm. or ℥j.

M. For herpes, herpes zoster, dermatalgia, and paræsthesia.

℞ Extracti cocæ	4		Gm. or 3j.
Zinci carbonatis	8		Gm. or 3ij.
Camphoræ		65	Gm. or gr. x.
Sulphuris sublimati	1	30	Gm. or gr. xx.
Ungt. aquæ rosæ	31		Gm. or ℥j.

M. For eczema around the genital organs.

℞ Cocainæ hydrochloridi		65	Gm. or gr. x.
Mentholi		65	Gm. or gr. x.
Bismuth. subnit.	4		Gm. or 3j.
Ungt. zinci oxidi, Adeps lanæ hyd. aa	15	5	Gm. or ℥ss.

M. Beneficial in urticaria, herpes, and herpes zoster.

[1] *Gazette Médical de Liège*, Dec. 1, 1898.

℞ Cocainæ hydrochloridi,
Hydrarg. chloridi mitis ..... aa | 65 Gm. or gr. x.
Zinci carbonatis ..... 4 | Gm. or ʒj.
Betanaphthol.,
Camphoræ ..... aa | 32 Gm. or gr. v.
Ungt. zinci oxidi ..... 31 | Gm. or ʒj.

M. Valuable in infantile eczema.

These ointments are serviceable in dermatitis, acute eczema, dermatalgia, herpes zoster, paræsthesia, urticaria, burns, and irritable and painful ulcers. Bleuler recommends the use of a 1-per-cent. cocaine salve made up with equal parts of lanolin and vaselin, in cases of herpes zoster. The tendency to spread is removed immediately, and pain at once disappears, with a resultant cure in from eight to ten days. Cocaine ointment allays the pain of ulcerated carcinoma and is beneficially applied to painful hæmorrhoids. On account of its astringent and slightly-stimulant action, coca ointment is sometimes an efficient application in acne and rosacea. An anodyne ointment may be thus composed:—

℞ Cocainæ hydrochloridi ..... | 65 Gm. or gr. x.
Morphinæ sulphatis ..... | 13 Gm. or gr. ij.
Atropinæ sulphatis ..... | 065 Gm. or gr. j.
Pulveris marantæ ..... 4 | Gm. or ʒj.
Unguenti zinci oxidi ..... 31 | Gm. or ʒj.—M.

In the treatment of burns, cocaine hydrochloride should be preferably mixed with hydrated wool-fat, since the latter substance possesses undoubted efficacy in the treatment of this form of lesion.

℞ Cocainæ hydrochloridi ..... 1 | Gm. or gr. xv.
Adipis lanæ hyd. ..... 46 | 6 Gm. or ʒiss.
Sodii bicarbonatis ..... 8 | Gm. or ʒij.
Ol. olivæ ..... q. s.

M. et ft. ungt. mollis.

℞ Cocainæ hydrochloridi ..... | 65 Gm. or gr. x.
Adipis lanæ hyd. ..... 31 | Gm. or ʒj.
Bismuth subnit. vel plumbi carbonatis ..... 8 | Gm. or ʒij.
Ol. olivæ ..... q. s.

M. et ft. ungt. mollis.

Cocaine is a valuable remedy in pruritus ani or vulvæ and in some cases of eczema. In rhus poisoning and erythema, a solution of cocaine promptly relieves the burning pain. Cocaine can be employed in the form of a solution according to the following formulæ:—

℞ Cocainæ hydrochloridi ..... | 20 Gm. or gr. iij.
Plumbi acetatis ..... | 65 Gm. or gr. x.
Glycerini ..... 45 | c.cm. or fʒiss.
Aquæ destillatæ ..... 135 | c.cm. or fʒivss.

M. Sig.: Use as an injection in the urethra in subacute and chronic gonorrhœa.

℞ Cocainæ hydrochloridi ..... | 13 Gm. or gr. ij.
Creosoti ..... | 50 c.cm. or *m* viij.
Glycerini ..... 30 | c.cm. or fʒj.
Aquæ hamamelidis dest. ..... 90 | c.cm. or fʒiij.

M. Sig.: Spray into the nose or throat in simple catarrh, pharyngitis, laryngitis, and in hay fever.

℞ Cocainæ hydrochloridi..... |25 Gm. or gr. iv.
Glycerit plumbi subacetat
Aquæ hamamelidis dest. .....aa 60| c.cm. or f℥ij.

M. Sig.: Apply over the surface on soft linen, for burning and itching of erysipelas, poisoning of the skin from various plants, and in sunburn and superficial heat-burns.

℞ Cocainæ hydrochloridi,
Hydrastini hydrochloridi.....aa |20 Gm. or gr. iij.
Aquæ rosæ .....120| c.cm. or f℥iv.

M. Sig.: Mop upon the skin or apply with old muslin or cotton, for seborrhœa oleosa, urticaria, acne, and rosacea.

Brushing the surface with a 10-per-cent. cocaine solution to which 1 per cent. of carbolic acid has been added is recommended for relieving pain in acute tonsillitis.

In gastralgia, the use of cocaine, or of a hot infusion of coca-leaves, is often highly serviceable and yields prompt relief. Cocaine hydrochloride is an efficient remedy in nausea and vomiting. In the hands of Dr. Manassein it yielded excellent results in the incessant vomiting and collapse of cholera morbus. Prompt relief often follows its use in migraine. In seasickness and the vomiting of pregnancy, the alkaloid is often useful. In the latter condition it has been used by the mouth, by injection into the epigastrium, or applied in ointment form to the os uteri. Mr. John Phillips afforded permanent relief by administration of the following mixture:—

℞ Cocainæ hydrochloridi ..... |006 Gm. or gr. $^1/_{10}$.
Tinct. aurantii ..... |60 c.cm. or *m*x.
Mist. chloroformi ..... 2 c.cm. or f℥ss.
Aquæ ..... q. s. ad 4| c.cm. or f℥j.

M. Pro dosi.

A. Pozzi reported[1] that, at the Obstetrical Clinic at Turin, five cases of pregnant vomiting, which persisted in spite of the hypodermic injection of morphine and the internal administration of cocaine, were rapidly cured by Tibone by subcutaneous injections of 0.01 Gm. (or gr. $^1/_6$) of the cocaine hydrochloride in the epigastrium, repeated once or twice a day before meals. Food was retained, and neither pulse, respiration, nor temperature was injuriously affected. The general condition gradually improved, the patients gained weight, and the vomiting did not return when the injections were omitted. Pozzi suggests that this treatment may prove useful in other forms of vomiting.

Dr. Carlson has reported a severe case of ptyalism accompanying pregnancy, in which rapid and complete relief was obtained by a few hypodermic injections of cocaine.

As an analgesic mixture which may replace an opiate, Portier recommends:—

℞ Cocainæ hydrochloridi..... |50 Gm. or gr. viiss.
Acetphenetidin..... 1|50 Gm. or gr. xxiiss.
Methylacetanilidi ..... |50 Gm. or gr. viiss.
Acid. salicylic. ..... 1| Gm. or gr. xv.

M. et div. in chart. no. x.
Sig.: One powder every three hours until pain has disappeared.

[1] *Arch. d' Ost. e Gyn.*, 1898.

When coca is used as a tonic in cases of debility, slow convalescence after fever, weak digestion, etc., it is usually in the form of an elixir or wine, the alcohol in these cases being synergistic, and possibly in many instances the more active agent in the combination. In these conditions the dangers of the formation of an alcohol habit must be borne in mind, and a change made to the solid extract or an infusion. In laryngeal tuberculosis associated with dysphagia, the use of cocaine has been found of marked benefit. In the treatment of secondary syphilis, Dr. R. W. Taylor often makes use of coca, especially in the case of debilitated subjects, as a tonic adjuvant to specific medication. He employs the fluid extract and may combine it with the compound tinctures of cinchona and gentian. The weak heart of typhoid fever is supported by 0.015 Gm. (or gr. $^1/_4$) doses, every two hours, of cocaine hydrochloride, as recommended by J. M. DaCosta. According to Thorington, cocaine is of decided efficacy in yellow fever, as it quiets the stomach and stimulates the heart.

A decided aphrodisiac effect has sometimes been ascribed to cocaine, but in two cases Dr. Arthur G. Hobbs has observed a contrary influence. In consequence of an application to the throat and nose a rapid and permanent relief of priapism followed after the usual remedies had been employed in vain. The cocaine had, in each instance, been employed on account of coincident nasal and pharyngeal inflammation. Wells has likewise observed the same effect follow applications to the nasal and pharyngeal mucous membranes. This writer has satisfied himself experimentally that cocaine depresses sexual excitability in men. He has likewise observed the same effect follow the internal administration of the remedy.

In various nervous disorders—hiccough, asthma, chorea, paralysis agitans, alcoholic tremors, senile tremor—Bartholow declared that cocaine produces more favorable effects than any other remedy. In asthma, Dieulafoy has often afforded relief by the application of a 5-per-cent. solution to the nasal chambers. Dr. J. K. Bauduy, of St. Louis, has found the alkaloid of decided service in melancholia, though in the experience of most neurologists it is of no permanent avail in this affection.

Murrell, of London, recommends the local use in neuralgia of a 20-per-cent. solution of the cocaine hydrochloride dissolved in oil of cloves. Of this solution 0.30 to 0.60 c.cm. (or *m*v-x) is rubbed in with the finger over the seat of pain. The pain of gouty joints may also be diminished by local application of this combination.

Several writers have testified to the efficacy of cocaine in small-pox. A solution is given internally in doses proportionate to the age of the patient. Dr. E. Pepper, of Algiers, states that a marked tolerance for the remedy exists in this disease. He states that the evolution of the pustules is arrested and that the course of the fever is shortened.

Waugh has used coca largely in the treatment of alcoholism. For acute cases he temporarily employs the following:—

℞ Tinct. capsici	30	c.cm. or f℥j.
Vini cocæ	210	c.cm. or f℥vij.

M. Sig.: A tablespoonful every two to four hours.

To assist in overcoming the habit of alcohol drinking, he gives coca-leaves in the form of a masticatory, which can be easily carried and taken without attracting notice. He believes that the source of the longing for

drink is often to be found in the mouth, and that coca when chewed exerts a local anæsthetic effect, as well as a general systemic action. The wine of coca is useful in giving tone to the vocal cords and preventing hoarseness in professional speakers and singers.

The rectal injection of a cocaine solution relieves the tenesmus and pain of hæmorrhoids. Used as an injection, or applied upon a pledget of cotton, cocaine allows many gynæcological operations to be painlessly performed. Vesico-vaginal fistulæ, laceration of the cervix uteri, and urethral caruncles have been successfully treated in this way without a resort to general anæsthesia. Cocaine likewise affords relief in vaginismus. Dilatation and curetting of the uterus, trachelorrhaphy, colporrhaphy, and perineorrhaphy can likewise be performed in the same manner. A solution applied, by means of a gauze compress, to the uterine neck may relieve rigidity during labor.

Shortly after the introduction of cocaine as a local anæsthetic Dr. Leonard Corning, of New York, demonstrated that it was possible under its influence to remove large tumors and perform amputations. Continuing his researches, he developed, in 1885, a method of injecting the drug into the vertebral canal between the spinous processes. Professor Bier, of Kiel, put Corning's suggestion to further clinical trial by means of the lumbar puncture,[1] and his example was speedily followed by many of the distinguished surgeons, notably Tuffier, Réclus, Oberst, Murphy, and Marx. The method employed is to introduce a suitable needle between the fourth and fifth lumbar vertebræ into the subarachnoid space, allowing a small quantity of the cerebro-spinal fluid to escape, and injecting with a hydopermic syringe a solution containing 0.005 to 0.01 Gm. (or gr. $^1/_{12}$-$^1/_6$) of cocaine. Analgesia of lower half of the body follows in a few minutes and persists for several hours. Tuffier[2] published 125 cases, including 58 laparotomies, of lumbar puncture with five deaths, though he states that only one death is directly attributable to this treatment. Spinal cocainization has also been used by Kreis and Marx[3] in obstetrical practice, who found that the cocainization did not interfere with the functions of the uterus. These injections are often attended with more or less severe after-effect: headache, vomiting, depression, and rising temperature. In a number of cases observed by the author a series of most alarming symptoms followed the use of this method, so that it is not without danger.[4] Six deaths have been recently reported by P. Réclus in his statistics of less than 2000 applications. Intrarachidian injections of cocaine as a therapeutic method have been tried recently by Dr. Achard in cases of sciatica. Marie and Guillian[5] report its use in one case of sciatica, when 5 milligrammes (or gr. $^1/_{12}$) were injected, with an immediate noticeable improvement, the man being able to get up and walk about without any appreciable pain. When a small dose is given there is no associated cutaneous anæsthesia, nor are there any constitutional symptoms occasioned, while the relief is as prompt as in the larger quantity.

Anæsthesia of the lower extremities and of the lower part of the abdomen, by the injection of a very minute quantity of $^1/_2$-per-cent. solution of cocaine hydrochloride into the spinal canal, is now a well-established surgi-

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[1] *Deutsche Zeitschrift für Chirugie*, vol. ii, p. 361, 1899.
[2] *La Semaine Médicale*, May 16, 1900.
[3] *Medical News*, August 25, 1900, and *Medical Record*, Oct. 6, 1900.
[4] *Journal of the American Medical Association*, Nov. 24, 1900.
[5] *Lancet*, April 13, 1901.

cal procedure. No injurious effects were observed in the six major surgical operations done under this form of anæsthesia by Bier, of Kiel.[1] The average amount of the drug administered was 0.005 Gm. (or gr. $^1/_{12}$). Anæsthesia of both the lower extremities is usually produced in about eight or ten minutes after the injection of the drug into the lumbar region of the spinal canal. Seldowitsch has also reported[2] four cases in which he had successfully employed this method for major operations, such as a Pirogoff amputation of the foot, extirpation of inguinal glands for melanosarcoma, and a resection of the knee. Sensation returned in every case within a short time, and there were no serious after-effects observed. The patients suffered only from a slight chill and elevation of temperature and pulse. Few had vomiting preceded by vertigo and headache, though in the more recent investigations these after-effects have been more prominent.

Neural infiltration is practiced by injecting a solution of cocaine directly into the sheath, or areolar tissue around the nerves supplying a part. The cocaine acts upon the nerve-trunks at the level of the injection, and the entire part distal to the injection-level is rendered anæsthetic. This, which was suggested by Oberst, is easy of performance, and is free from danger. It is especially applicable to the digits. In anæsthetizing a finger, a soft-rubber tube is first tied around its base, to arrest the circulation. Then 5 or 10 minims of sterilized 1-per-cent. solution of cocaine is injected around each digital nerve, distal to the tourniquet. In about ten minutes, the entire finger is anæsthetic and can be subjected to operation, without pain. By the addition of a small quantity of adrenalin the action is intensified.

Cocaine is used as an injection into the urethra in gleet and previous to passage of instruments or surgical operations. The injection of a few drops of a 4-per-cent. solution into the urethra in case of stricture of large calibre may succeed in relieving retention of urine. In such procedures, however, it must be borne in mind that the urethral and rectal mucous membranes absorb with great rapidity, and a strong solution must, therefore, be avoided. Berger has reported a case of death from injection of 0.5 Gm. (or gr. viij) of cocaine dissolved in a spoonful of water, the fluid being allowed to escape immediately and the entire quantity being apparently recovered. Death has followed the injection of a 5-per-cent. solution of cocaine into the urethra, apparently from shock.

Cocaine, or the fluid extract of coca, in conjunction with other remedies, is a physiological antidote to narcotic poisoning by opiates or picrotoxin, and may be used hypodermically. The subcutaneous injection of cocaine has been found useful in cases of scorpion-bite. The treatment rapidly relieves pain and restricts it to the part stung.

COCCULUS—COCCULUS INDICUS.—Indian Berry, Fish-berry.

Preparation.

Picrotoxinum (U. S. P., B. P.).—Picrotoxin (the active principle). Dose, $^1/_2$ to 1 mg. (or gr. $^1/_{120}$-$^1/_{60}$). B. P., 0.00065 to 0.0027 Gm. (or gr. $^1/_{100}$-$^1/_{25}$).

Pharmacology.—Cocculus Indicus is not official, but its active principle

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[1] *Deut. Zeit. für Chirurgie*, vol. li, p. 344.
[2] *Centralblatt für Chirurgie*, B. 26, 1899, p. 1110.

is. It is the fruit of Anamirta paniculata (Menispermaceæ), a native of the Malabar coast and of India. In 1812, Boullay discovered and isolated a peculiar bitter principle, which he denominated **Picrotoxin**,—a white, crystallizable, neutral substance, soluble in 150 parts of cold water, or in 25 of boiling, and very soluble in alcohol and ether, but not soluble in oils. Picrotoxin does not form salts. Like digitalin, picrotoxin appears to be made up of several bodies, which vary in their chemical properties and effects. Barth and Kretschy assert that it contains at least three: (1) picrotoxin, a bitter, poisonous principle; (2) picrotin, a bitter, non-poisonous principle; and (3) anamirtin. To these has been added cocculin (which is said to be identical with anamirtin). These pharmaceutical bodies may have scientific interest, but, practically, the prescriber is confined to the picrotoxin of Boullay, which is official in the United States Pharmacopœia. In the pericarp have been found menispermia, paramenispermia, hypopicrotoxic acid, resin, fat, and gum, which do not possess much medical interest.

Physiological Action.—Cocculin, or picrotoxin, is very destructive to lower forms of life, and to many acts as an acrid, narcotic poison. In lower animals death is preceded by convulsions, and in a fatal case of a child six years old, poisoned by absorption of a strong alcoholic solution of the fruit applied to the scalp, tetanic spasms occurred. Where this agent has been swallowed, the usual treatment, by evacuating the stomach, should be practiced, with inhalation of ether or ammonia and the internal administration of chloral or bromides. There is an antagonism between chloral and picrotoxin, and this can be utilized when poisoning has occurred from absorption through the integument. Tannic acid and stimulants are also useful.

In an article by William Murrell, of London, on "Picrotoxin and its Properties,"[1] this able authority states that the peculiar convulsions produced by this agent "differ essentially from the tetanic condition caused by strychnine, and are due to stimulation of the motor centres in the cerebrum, or in the medulla and cord. They assume various forms, the swimming, running backward, and moving round in a circle being the most common. Picrotoxin raises the temperature, stimulates the respiratory centre, and in large doses produces salivation." It acts as an anhydrotic by stimulation of the respiratory centre. "It is allied to **Cicutoxin**—the active principle of the water-hemlock—and to **Coriamyrtin**, derived from **Coriaria myrtifolia.** These drugs stimulate the origins of the inhibitory fibres of the vagus, the vascular and respiratory centres, and the motor areas of the medulla oblongata. In its action on the secretions picrotoxin is allied to **Pilocarpine** and **Muscarine**, and is antagonized by atropine and other members of that group. The best antidotes to picrotoxin are chloral hydrate and bromide of potassium." On account of its poisonous effects, cocculus has been used, from ancient times, made up into paste and thrown into the water, where the fish are stupefied by it, and are easily captured. Death has occurred in a boy from eating a small quantity (40 grains) of such paste, but it is said that the flesh of the fish so taken is edible. This unsportsmanlike method of fishing in most parts of this country is illegal. On account of its bitterness, cocculus, or "fish-berry," is sometimes added to malt liquor to save hops and check fermentation. Possibly this may enter into the solution of the problem of what is the matter with a man when he is drunk, and still further emphasize

[1] *The Medical Bulletin*, Nov., 1890, p. 402.

the importance of regarding intoxication as a condition of poisoning, demanding prompt, intelligent, and skillful treatment.

Therapy.—Cocculus is an ancient remedy for phtheiriasis, or lousiness, but care should be exercised in the case of children, or where there are abrasions on the scalp, not to use strong solutions, nor to leave them for many minutes in contact with the skin. The hairy scalp, after being thoroughly washed with soap and water, is wet with a solution (15 to 120 c.cm., or f℥ss of the tincture to f℥iv water), or decoction (1 to 16), and after a few minutes washed off with an abundance of warm water. Two or three daily applications are sufficient, especially in cases where the hair can be cut short, as in charitable institutions and asylums. It has been claimed that an ointment of picrotoxin is equally efficient with the decoction, but it cannot be regarded as being as safe. For the same reason, cocculus is not advised in the treatment of tinea and other skin affections, although still used for this purpose in India. A small quantity, however, of picrotoxin—not exceeding 1 per cent.—may be usefully prescribed, in combination with ointment of mercuric oleate, for the relief of animal and vegetable parasitic diseases, as scabies, pediculi, trichophytosis, and tinea versicolor.

Picrotoxin in small doses appears to act as a bitter tonic to the digestive tract, and has therefore been advised in atonic conditions of the stomach and intestinal indigestion attended by torpor of the intestinal walls, and constipation. Flatulence and colic are relieved by the use of picrotoxin. The remedy has likewise been successfully used in painful dyspepsia, vomiting, vertigo, and other reflex manifestations dependent upon imperfect digestion.

In epilepsy, chorea, alcoholic tremor, paralysis agitans, and functional nervous disorders (migraine, dysmenorrhœa) picrotoxin has been used successfully by Planat and Hammond, Gubler, Phillips, and others. It has been found beneficial in epilepsy, especially when the attacks occur by night or are due to anæmia. According to the experience of Dr. d'Amore, picrotoxin is of special benefit in advanced cases of the disease. In a number of cases observed by d'Amore its effect was more permanent than that of atropine. Semmola and Gioffredi have recently reported a case in which picrotoxin succeeded in checking profuse hyperidrosis which developed consecutive to an attack of influenza. There is good evidence in support of the statement made by Murrell as to its value in controlling night-sweating in phthisis in doses of 1 mg. (or gr. $^1/_{60}$), in a pill with sugar and tragacanth (a single dose, at bed-time, or given three times a day). It does not have the disagreeable action upon the throat and skin that atropine has, and frequently succeeds where that fails; but it is slower in producing its anhydrotic effect, requiring several days. Bókai regards picrotoxin as an excellent antidote to opium by reason of the stimulant action of the former substance upon the respiratory and vasomotor centres.

COCCUS (U. S. P., B. P.).—Cochineal.

Preparation.

Tinctura Cocci (B. P.).—Tincture of Cochineal (1 to 10). Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Pharmacology.—The dried female insects of Pseudococcus cacti (Insecta; order, Hemiptera), when crushed, produce a very brilliant-red color-

ing matter, which consists principally of carminic acid, various salts, tyrosin, urea, fatty matters, etc. The British Pharmacopœia defines coccus as "the dried fecundated female insect Coccus cacti, reared on Nopalea coccinellifera and on other species of Nopalea." The pigment called **Carmine** is the coloring matter precipitated from the decoction by acids, and the salts of tin, or by gelatin; and other colors—such as lake, purple, and lilac—may be obtained by various reagents. It is highly prized in the arts as a coloring agent. As such it is also used in pharmacy, and is an ingredient in the compound tincture of cardamom.

Physiological Action.—The physiological actions of cochineal are not very evident, but it is believed to have antispasmodic and anodyne qualities.

Therapy.—Cochineal was used by a preceding generation of physicians for whooping-cough and in neuralgia. Its brilliant color possibly might have led to its use under the old doctrine of signatures.

COCHLEARIA.—Scurvy-grass, Cochlearia officinalis (Cruciferæ), an annual or biennial plant of northern Europe and United States, contains tannin, a bitter principle, salts, and a volatile oil. It is stimulant, diuretic, and laxative. Cochlearia is popularly eaten as a salad, and is efficacious in scorbutus, chronic rheumatism, and chronic malaria. The juice has been used externally for the purpose of stimulating indolent ulcers, and, diluted with water, as a mouth-wash for spongy gums and ulcers of the mouth.

COCILLANA.—Cocillana. The Cocillana of Bolivia, a Guarea of undetermined species, is a large tree belonging to the Meliaceæ. The name Sycocarpus Rusbyii, bestowed upon the tree by Professor Britton, has been generally accepted. It was discovered and brought to this country by the American botanist, Dr. H. H. Rusby, who also introduced pichi, another valuable South-American remedy. The constituents of the bark have not been determined, but it is probable that it owes its effects to an active principle, resinous in character, soluble in chloroform (Schrenk), or perhaps an alkaloid (Rusby). The odor of the resinous principle is peculiar and characteristic; its taste is bitter, mawkish, and slightly astringent.

Physiological Action and Therapy.—The bark is used as an expectorant, having an influence upon the respiratory organs similar to ipecac, but "superior to it in certain diseases of the air-passages, in which the latter is often used," in the opinion of D. D. Stewart.[1] It also has a tonic effect upon the digestive organs, and gives promise of usefulness as a laxative. In native medicine cocillana is used as an emetic and cathartic. A free discharge of mucus, nausea, and gagging, with some tendency to perspiration, also dizziness and lassitude, were caused in one case where 1.30 Gm. (or gr. xx) were given. Larger doses (2 to 3.25 Gm., or gr. xxx-l) caused vomiting at the end of an hour, evacuations of the bowels, sneezing, and prostration, the effects resembling those of emetine. The active principle is excreted chiefly by the mucous membrane of the respiratory tract, upon which it acts as a stimulant.

Small doses improve the appetite and digestion. The alvine discharges under its use contain mucus and bile. This drug stimulates the sudoriparous

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[1] *Medical News*, Aug. 24, 1889.

glands. When given in considerable quantities it causes copious perspiration, accompanied by prostration of muscular strength. Excessive quantities excite severe gastro-intestinal irritation, and have, in some reported cases, caused death.

This drug finds its special usefulness in bronchitis, particularly the subacute and chronic forms. The fluid extract is preferable to the tincture in acute bronchial attacks. Cocillana is an effective remedy in coryza, spasmodic croup, persistent hoarseness and cough after measles, the cough of influenza, asthma, hay fever, and in the declining stage of pneumonia. It relieves the cough of pulmonary tuberculosis.[1] Small doses of cocillana have likewise been used with success in atonic dyspepsia. The fluid extract diluted with water and used as a spray has been recommended as a useful application in acute and chronic coryza.

CODEINA (U. S. P., B. P.).—**Codeine** ($C_{18}H_{21}NO_3 + H_2O$).
Dose, 0.015 to 0.13 Gm. (or gr. $^1/_4$-ij).

Preparations.

Codeinæ Phosphas (U. S. P., B. P.).—Phosphate of Codeine. Dose, 0.015 to 0.13 Gm. (or gr. $^1/_4$-ij).

Codeinæ Sulphas (U. S. P.).—Sulphate of Codeine. Dose, the same.

Syrupus Codeinæ (B. P.).—Syrup of Codeine (codeine phosphate, 4.57 Gm.; distilled water, 12.5 c.cm.; syrup, 987.5 c.cm.; 4 c.cm., or f3j, = 0.015 Gm., or gr. $^1/_4$). Dose, 2 to 7.5 c.cm. (or f3ss-ij).

An alkaloid contained in opium (0.1 to 2 per cent.). It is prepared from opium, and also artificially from morphine. Codeine does not disorder the stomach or bowels, and does not give rise to sweating or eruptions upon the skin. A few cases have been reported in which dizziness, nausea, vomiting, and prostration were caused by codeine in medicinal doses. Behier has reported a case of chronic codeinism; but these untoward effects are exceptional. It is more antispasmodic than morphine and has less narcotic effect (D. Loewenmyer[2]). It is used preferably in the treatment of cough, cramps in the stomach or bowels, and in neuralgia and painful affections of the genito-urinary organs. In diabetes it checks the formation of sugar, and in some cases permanently arrests it. In these cases it is borne well in larger amounts, as much as 0.65 to 1 Gm. (or gr. x-xv) daily having been taken with benefit. Fraser claims, however, that equally good effects may be obtained in smaller doses from morphine hydrochloride, which is also very much cheaper.

In the treatment of mental disorders, such as melancholia, psychic disturbance associated with change in general sensibility, anxiety, and moral suffering, codeine has been found useful by Jules Clausse (Paris Thesis). It is valuable as a hypnotic in the insomnia of melancholia. It is positively contraindicted in intense excitement and in maniacal conditions. Dr. Perininger finds codeine of value in pulmonary tuberculosis with insufficient expectoration, troublesome cough and chest-pains. In bronchitis it also proved of service, caused no disorder of the stomach, and even seemed to benefit some cases of dyspepsia. In pertussis its use was attended with good results.

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[1] See paper by author on "The Therapeutical Applications of Cocillana" in *Medical Bulletin*, Feb., 1893.

[2] *Deut. med. Woch. and Weekly Med. Review*, Nov. 29, 1890.

COFFEA.—**Coffee.** The dried seeds of Coffea Arabica (Rubiaceæ) are only officially recognized as one of the sources of **caffeine:** its most important constituent. Before roasting, coffee contains **Caffeine** and caffeotannic acid. Dr. Palladine has isolated a new alkaloid which he terms **caffearine,** and which occurs in the form of crystalline needles, soluble in water and alcohol. Caffeine hydrochloride is very soluble in water, but does not dissolve in absolute alcohol. During roasting a volatile oil is developed and several substances formed, which give to coffee its aroma and flavor, these empyreumatic substances being known collectively as **Caffeone.** It is suggested, therefore, that the use of coffee may prove of some prophylactic value during epidemics of those infectious diseases which are commonly transmitted through the medium of drinking-water. Strong infusions of coffee, as Luderitz has shown, are destructive to the organisms of typhoid fever, erysipelas, and cholera. (See also **Caffeina,** U. S. P., B. P., p. 284.)

Physiological Action.—Coffee differs from caffeine in being more stimulating to the intestinal tract, especially increasing the peristaltic movements, which are not affected by caffeine. Taken in the morning, before rising, coffee will often produce a laxative effect. It produces a general feeling of warmth and well-being, dilates the superficial blood-vessels, and lowers arterial pressure. It also stimulates the nervous system, in some persons causing exhilarating effects upon the cerebrum and increasing capacity for intellectual labor, and frequently is the cause of headaches in persons who take it habitually or in excess. A case has been reported[1] in which about 77.6 Gm. (or ℥iiss) of the ground berries were made into a strong infusion and swallowed by a vigorous man. Two and a half hours later he was attacked by dizziness, severe cardiac pains, palpitation, nausea, vomiting, and generalized tremors. The tremors persisted for twelve hours after all other symptoms had disappeared.

The habitual use of coffee is one of the causes of pruritus ani. Overindulgence in its use is also apt to disturb the liver and cause the familiar manifestations known as "biliousness," or even slight jaundice.

Therapy.—It is valuable as a stimulant in cases of narcotic poisoning, especially by opium. In some cases it produces fullness of the portal circulation, interfering with the activity of the hepatic functions and causing hæmorrhoids. Its laxative effects are useful in persons leading sedentary lives, in preventing constipation. It has some astringent and antiseptic qualities, and is believed to have some effect in preventing malaria. According to the observation of Dr. Alice McLean, the use of coffee by nursing women diminishes the secretion of milk. The fluid extract of the unroasted coffee contains caffeine, but no caffeone. It is used in anæmic headaches, and in cases of low fever as a cardiac stimulant where collapse is threatened.

COLA.—(See **Kola**).

COLCHICI SEMEN (U. S. P., B. P.).—**Colchicum-seed.**

COLCHICI CORMUS (U. S. P., B. P.).—**Colchicum-corm.**
Dose, 0.13 to 0.32 Gm. (or gr. ii-v).

COLCHICINA (U. S. P.).—**Colchicine.** An alkaloid obtained from Colchicum.

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[1] *Therapeutische Monatschefte,* March, 1890.

Preparations from the Root.

Extractum Colchici Cormi (U. S. P.).—Extract of Colchicum-corm. Dose, 0.015 to 0.065 Gm. (or gr. $^1/_4$-j).

Fluidextractum Colchici Radicis.—Fluid Extract of Colchicum-root. Dose, 0.12 to 0.24 c.cm. (or *m*ii-iv).

Vinum Colchici Radicis.—Wine of Colchicum-root (40 per cent.). Dose, 0.30 to 2 c.cm. (or *m*v-f3ss).

Extractum Colchici (B. P.).—Extract of Colchicum. Dose, 0.015 to 0.065 Gm. (or gr. $^1/_4$-j).

Vinum Colchici (B. P.).—Colchicum-wine (20 per cent.). Dose, 0.60 to 2 c.cm. (or *m*x-xxx).

Preparations from the Seed.

Fluidextractum Colchici Seminis (U. S. P.).—Fluid Extract of Colchicum-seed. Dose, 0.12 to 0.30 c.cm. (or *m*ii-v).

Tinctura Colchici Seminis (U. S. P.).—Tincture of Colchicum-seed (10 per cent.). Dose, 0.30 to 4 c.cm. (or *m*v-f3j).

Vinum Colchici Seminis (U. S. P.).—Wine of Colchicum-seed (10 per cent.). Dose, 0.60 to 4 c.cm. (or *m*x-f3j).

Tinctura Colchici Seminum (B. P.).—Tincture of Colchicum-seeds (20 per cent.). Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Colchicina (non-official).—Colchicine (the active principle). Dose, $^3/_4$ to 1 mg. (or gr. $^1/_{100}$-$^1/_{60}$).

Pharmacology.—Colchicum-corm is the dried corm of Colchicum autumnale (Liliaceæ), or meadow-saffron, yielding 0.35 per cent. of colchicine. Colchicum is native to the temperate parts of both Europe and northern Africa. The seed is also official. It contains **Colchicine** (.55 per cent., or rather more in the seeds than in the root); and traces of **Veratrine** in combination with gallic acid and a fixed oil are found. The value of colchicum is tested by its bitterness, due to the presence of colchicine, an alkaloid, appearing in small crystals (Geiger and Hesse), which is soluble in water and alcohol, but is changed by most acids into **Colchiceine,** a neutral substance, and a resin, both isomeric with colchicine. Wine and vinegar extract the medicinal principles from the drug, and the official extract is made with the aid of acetic acid. Propably each of them contains a small amount of colchiceine. In ordering the wine it is necessary to designate which preparation is required, as the wine of the seeds differs in effects from that of the root, on account of the difference in content of colchicine, which is not entirely equalized by the pharmacopœial expedient of altering the proportion of crude drug in each. The fresh seed contains a small portion of volatile, but very active, oil, and the best preparation would be a tincture made from the fresh seeds in alcohol; but colchicine, when administered in granules, pill, or by hypodermic injection, is said to secure the full therapeutic effect.

Physiological Action.—When applied to the skin, colchicum acts as an irritant, causing hyperæmia and smarting, and the dust inhaled causes sneezing and conjunctival injection. In small doses it occasions an acrid taste in the mouth, increased secretions from the salivary glands due to reflex action, and gastro-intestinal disturbance, which increases with the quantity taken. The pulse-rate is decidedly reduced, and in some cases a diaphoretic effect is observed. A single large dose or small ones long continued cause violent vomiting and purging (first serous, then mucous, then bloody), or acute gastro-intestinal irritation. Marked symptoms of collapse supervene: the pulse becomes small, rapid, and thready; the skin cold and bedewed with

sweat; respiration slow and painful. Death ensues from collapse, the brain remaining clear to the last. Sometimes nervous symptoms, flying pains, and numbness may appear, and occasionally, though rarely, convulsions (Brunton). Pains in the joints and urinary passages also may be produced by colchicum.

In some instances the action of the kidneys is but slightly affected, in other cases it is increased, and again it may be diminished or suppressed. In fatal cases of colchicum poisoning the blood has been found of a dark color and impaired coagulability. The intestinal mucous membrane is highly inflamed, and this effect is equally produced even when the alkaloid has been given by the hypodermic method. A very large dose does not cause a more marked effect than a moderately large one. The action upon the alimentary canal is the same, whether the drug be swallowed or hypodermically injected. When, during the administration of colchicum, there appear irritation of the fauces, loaded tongue, loss of appetite, flatulence, uneasiness, or pain in the stomach and diarrhœa, the drug is beginning to exercise toxic effects, and should be discontinued or suspended for a time. Colchicum has a selective action upon the sensory nerves and spinal cord, which are more or less paralyzed; the brain, motor nerves, and muscles are not affected. The inhibitory fibres of the vagus are paralyzed only by very large doses. The discharge of bile and of urine is largely increased; Rutherford claims that it is a true cholagogue, and Christian and others assert that it is diuretic, increasing the quantity of salts as well as the water, both of which have been denied by Gubler, who simply regards it as cathartic, only exercising good effects when three or four discharges from the bowels are obtained daily through its action. When symptoms of poisoning make their appearance, the patient should be kept in a recumbent posture, encouraged to vomit, and allowed to drink freely of infusion of tea or coffee, on account of the tannin they contain as well as their action as arterial stimulants. Morphine and atropine may be administered hypodermically in small doses. The administration of oil is of service on account of its emollient effect upon the mucous membrane. If collapse occurs, heat and cardiac stimulants are required. If there is much distress, sinapisms should be applied to the abdomen and the patient kept warm. Poisoning may occur in refilling prescriptions, as the preparations vary greatly in their activity; some samples of fluid extract contain very little, if any, of colchicine, while others are of standard strength. Fatal cases have been reported from taking 9.25 to 13 c.cm. (or f3iiss-iiiss) of the wine of colchicum-root. Dangerous symptoms have been caused by doses of 0.01 to 0.02 Gm. (or gr. $^1/_6$-$^1/_3$) of colchicine, and 0.03 Gm. (or gr. ss) of the alkaloid has caused death.

Therapy.—Colchicum may be used in small doses as an ingredient in cholagogic pills, but its chief use is in the treatment of attacks of gout and in the relief of symptoms more or less directly attributable to gout, as dyspepsia, bronchitis, asthma, etc. In rheumatic arthritis or rheumatic gout we may give:—

℞ Tincturæ colchici sem.	60	c.cm. or *m*x.
Potassii iodidi	65	Gm. or gr. x.
Syr. sarsaparillæ comp.	6	c.cm. or f3iss.
Aquæ destillatæ	2	c.cm. or f3ss.

M. Pro dosi. Take every three or four hours, well diluted.

℞ Vini colchici seminis	15	c.cm. or f3iv.
Sodii salicylatis	12	Gm. or 3iij.
Sodii iodidi	4	Gm. or 3j.
Spiritus chloroformi	11	c.cm. or f3iij.
Inf. buchu	ad 240	c.cm. or f3viij.

M. Sig.: A teaspoonful every three or four hours.

Scudamore's gout mixture is also very efficient:—

℞ Magnesii sulph.	62	Gm. or ℥ij.
Magnesii carbonatis	8	Gm. or 3ij.
Vini colchici seminis	22	c.cm. or f3vj.
Aquæ menth. pip.	ad 360	c.cm. or f℥xij.

M. Sig.: A tablespoonful every four hours.

Colchicum is generally given in acute attacks of gout, in combination with an alkali:—

℞ Magnesii sulphat.	15|5	Gm. or ℥ss.
Magnesiæ	8	Gm. or 3ij.
Tinct. colchici sem.	7|5	c.cm. or f3ij.
Syrupi zingiberis	30	c.cm. or f℥j.
Aquæ menthæ pip.	150	c.cm. or f℥v.

M. Sig.: Take a tablespoonful every two hours, until the bowels are freely moved from four to six times in twenty-four hours.

Or the extract of the root may be given (0.065 to 0.13 Gm., or gr. i-ij) several times daily, or the wine of the seeds in 2-c.cm. (or f3ss) doses:—

℞ Colchicinæ	|03	Gm. or gr. ss.
Codeinæ	|65	Gm. or gr. x.
Quininæ hydrobromidi	4	Gm. or 3j.

M. et ft. pil. no. xl.
Sig.: Take one every two hours for gouty neuralgia.

The wine of the seeds is, perhaps, the preparation most frequently prescribed, and in an acute paroxysm of gout is best given in a moderately large dose (2 to 4 c.cm., or f3ss-j). Within a few hours the pain is allayed and the heat and swelling begin to subside. In order to secure relief it is not necessary that the drug should manifest its diuretic or purgative effects. In chronic gout, small doses (1 to 1.20 c.cm., or *m*xv-xx) three or four times a day are appropriate. Though colchicum exerts an action which may be termed specific, it is nevertheless but palliative, since attacks recur. Of little or no value in acute rheumatism, colchicum is sometimes of service in the chronic form of this disease. Neuralgia dependent upon a gouty or rheumatic condition is often effectually treated by means of colchicum, a drachm of the wine being given at bed-time, together with a dose of morphine sulphate. The same preparation is not infrequently serviceable in gonorrhœa, and 2 c.cm. (or *m*xxx) at bed-time is an old treatment for chordee.

Ch. Abadie has found very minute doses of colchicine (0.001 gramme $= {}^{15}/_{1000}$ grain) two to four times a day to be of great value in scleritis, whether due to gout or rheumatism.

F. Woodbury recommends its hypodermic injection in sciatica, into the sheath of the nerves, also in muscular rheumatism.[1] A combination of colchicine with the natural salicylate of methyl is of value in subacute and

[1] *Philadelphia Medical Times*, vol. xiii, p. 154.

chronic rheumatism. In gouty neuritis, Dr. C. D. F. Phillips has found the following combination beneficial:—

℞ Colchicin.	.001 Gm.	or gr. $^1/_{60}$.
Quinin. sulphat.	.065 Gm.	or gr. j.
Ext. colocynthidis	.065 Gm.	or gr. j.

M. et ft. pil. no. j. Mitte tales no. xx.
Sig.: One pill three times a day.

Colchicum has also given good results in the treatment of ascites, gonorrhœa, and chordee.

COLLARGOLUM. (See **Argentum.**)

COLLINSONIA CANADENSIS.[1]—This indigenous plant, belonging to the natural order Labiatæ, and popularly known as stone-root, or knob-root, grows from April to October in richly-wooded soils throughout the United States. All parts of the plant may be used, but its virtues reside chiefly in the root, and depend principally upon the presence of a volatile oil. It possesses a rank, aromatic odor, and a warm, somewhat pungent taste.

Physiological Action.—Collinsonia is a local astringent. It exerts a sedative effect upon mucous membranes, and produces a sensation of warmth in the stomach and bowels. Large doses give rise to diaphoresis, nausea, and, perhaps, vomiting.

Therapy.—Collinsonia is a good local application to incised or contused wounds. Four Gm. (or ʒj) of the powdered root to 31 Gm. (or ℥j) of lard constitutes a stimulant application to indolent ulcers. The fluid extract, diluted with 4 parts of water and used as a rectal injection, effectually destroys ascarides.

This remedy, given internally, acts as an astringent tonic, antispasmodic, and sedative. It increases the appetite, promotes digestion and elimination, and is therefore useful in anæmia, chlorosis, the early stage of phthisis, and in convalescence from the eruptive fevers. Relaxed uvula, chronic pharyngitis, and hoarseness due to impaired tonicity of the vocal cords are benefited by the local action of collinsonia. A cup of hot infusion at bed-time will abort an ordinary cold, or mild lumbago. The fluid extract is very beneficial in gastro-intestinal catarrh, whether dependent upon alcoholism or other causes. The remedy is especially useful in the former case, since it seems to lessen the desire for liquor.

Various spasmodic affections are relieved by collinsonia. The hot infusion is a useful remedy in spasmodic croup. In whooping-cough the paroxysms are ameliorated, and it is valuable in nervous cough and the irritative cough of pharyngitis. It is sometimes of service in chorea. Spasmodic contraction of the sphincter ani not uncommonly gives rise to constipation, hæmorrhoids, neuralgia of the rectum, with vague pelvic and abdominal symptoms. This spasm and the train of disorders dependent upon it may often be relieved by the employment every night of a suppository containing from 0.65 to 4 Gm. (or gr. x-ʒj) of powdered collinsonia-root. Some cases of dysmenorrhœa are markedly benefited by the administration of the fluid extract for a week preceding and during the period. It is probable that vaginal suppositories containing this remedy would be

[1] See paper by author, in "Transactions of the Ninth International Medical Congress," vol. iii, p. 76. Washington, D. C., U. S. A.

of service in vaginismus. Excellent results are obtained from collinsonia in renal and biliary colic. Spasm of the ducts is relaxed, and the irritation of the mucous membranes soothed. The increased flow of urine induced facilitates the expulsion of small calculi. Infantile colic and flatulent colic in adults are also amenable to the influence of this drug. In combination with aconite and morphine it is more rapidly efficacious than any other treatment of acute cystitis, and should be tried in chronic cystitis.

Incontinence of urine in children and the dripping of a few drops of urine in adults after the act of micturition is apparently completed, due to hyperæsthesia of the prostatic urethra or neck of the bladder, may be effectually relieved by the fluid extract. The writer has seen it arrest the discharge of chronic gonorrhœa after the customary blennorrhetics had been exhibited in vain. It has likewise been found very beneficial in leucorrhœa and prostatorrhœa.

COLLODIUM (U. S. P., B. P.).—**Collodion.**

Preparations.

Collodium Stypticum (U. S. P.).—Styptic Collodion. External use.
Collodium Cantharidatum (U. S. P.).—Cantharidal Collodion. External use.
Collodium Flexile (U. S. P., B. P.).—Flexible Collodion. External use.
Collodium Vesicans (B. P.).—Blistering Collodion. External use.

Pharmacology.—Collodion is pyroxylin, or gun-cotton (4 parts), dissolved in ether (75 parts) and alcohol (25 parts). The British Pharmacopœia gives the proportions as pyroxylin, 10 Gm. (or ℥iiss); ether, 360 c.cm. (or f℥xij), and alcohol, 120 c.cm. (or f℥iv). **Blistering collodion** (U. S. P.) has cantharides (60 parts), exhausted by chloroform and evaporated (to 15 parts), to which is then added flexible collodion (85 parts). **Flexible collodion** (U. S. P.) is collodion (92 parts), to which Canada turpentine (5 parts) and castor-oil (3 parts) have been added. **Styptic collodion** (U. S. P.) contains tannic acid (20 parts) dissolved in alcohol (5 parts), ether (25 parts), and collodion (q. s. to make 100). Collodion is a clear, syrupy fluid, smelling strongly of ether; and should be kept in a glass-stoppered bottle, tightly corked, remote from lights and fire. When painted upon a surface, the ether quickly evaporates, leaving a film of pyroxylin, which is adhesive and tends to contract or pucker up.

Therapy.—Collodion is used to cover excoriated surfaces and to seal small wounds. Larger wounds may be drawn together and kept in position by strips of gauze, the ends of which are made to adhere to the skin by several coats of collodion painted on with a camel's-hair pencil. Sometimes it gives rise to pain, irritation, and even blistering when a comparatively large area is thus covered. The contraction caused by the drying of collodion is made use of in the treatment of the early stages of boils and styes, and the papules in small-pox, to prevent pitting. Where several coats are to be applied, the flexible collodion is preferable. It has also been used in herpes zoster and erysipelas, and the compression exerted by it has been utilized in the treatment of epididymitis, painting freely over the testicle and cord. A coating of collodion is likewise beneficial in the superficial variety of burns. This substance is an exceedingly useful application to scalp-wounds, in which, besides approximating the edges and excluding the air, it does away with the necessity for a bandage. The pressure produced by the con-

traction of collodion has been successfully utilized in the treatment of umbilical hernia, varicocele, and spina bifida. In pruritus ani, if collodion be applied, after antiseptic cleansing with solution of carbolic acid, marked relief will be afforded.

Several cases have been reported by French physicians in which the repeated application of collodion to the entire surface of the abdomen in tuberculous peritonitis was followed by recovery. In the nocturnal incontinence of urine in male children it is often advantageous to seal the orifice of the urethra or the end of the prepuce with collodion. This method will not infrequently break up the habit within a few weeks. The styptic collodion may be used on cracked nipples, or for small wounds where an astringent may be desired. Extract of cannabis Indica (2 parts), with salicylic acid (11 parts) in flexible collodion (87 parts), is a popular remedy for soft corns, under the name of the green solution for corns (collodium salicylatum compositum, N. F.), which, however, would probably be quite as efficient without the cannabis Indica. Iodine and iodoform have been used, dissolved in collodion, as an application to gouty or rheumatic joints, but the former sometimes has been followed by sloughing. Iodized collodion (contains 5 per cent. iodine in flexible collodion) is useful for chillblains.

Numerous collodion preparations have been suggested and employed for various purposes. Among these may be mentioned a 10-per-cent. chrysarobin collodion; a cocaine styptic collodion, containing 5 per cent. of cocaine hydrochlorate, 15 per cent. of tannic acid and 30 per cent. of alcohol; diachylon, 10 per cent., each of lead plaster and alcohol with 20 per cent. of ether; a collodion for freckles, containing 2 per cent. of sulphophenyl-zinc; collodions in which oleate of mercury, zinc, or other oleates are incorporated; a 10-per-cent. salol collodion for chapped hands, etc.

Crystalline.—A solution of pyroxylin in methylic alcohol has been introduced under the name of crystalline. The preparation is similar to collodion, but the solvent evaporates more slowly and the resultant pellicle is perfectly translucent. An elastic crystalline, corresponding to elastic collodion, has been made by Dr. Phillips, according to the following formula:—

℞ Crystallin.	18	5	c.cm. or f3v.
Ol. ricini	5		c.cm. or f3i ¼.
Terebinth. Canadensis	9	25	c.cm. or f3iiss.—M.

An excellent white varnish is made by mixing:—

℞ Crystallin.	30		c.cm. or f℥j.
Ol. ricini	4		c.cm. or f3j.
Zinc. oxid.	8		Gm. or 3ij.—M.

Pyrogallic acid, salicylic acid, chrysarobin, corrosive sublimate, and many other medicinal substances are readily soluble in crystalline, which may, therefore, be used with advantage as a vehicle for various substances in the treatment of tinea tonsurans, warts, eczema, acne, lupus erythematosus, etc.

COLOCYNTHIS (U. S. P.).—**Colocynth.**

COLOCYNTHIDIS PULPA (B. P.).—**Colocynth-pulp.**
Dose, 0.13 to 0.32 Gm. (or gr. ii-v).

Preparations.

Extractum Colocynthidis (U. S. P.).—Extract of Colocynth. Dose, 0.13 to 0.20 Gm. (or gr. ii-iij).

Pilulæ Catharticæ Compositæ (U. S. P.).—Compound Cathartic Pills (compound extract of colocynth, 80 Gm.; calomel, 60 Gm.; resin of jalap, 20 Gm.; and gamboge, 15 Gm., to make 1000 pills). Dose, 1 to 3 pills.

Pilulæ Catharticæ Vegetabiles (U. S. P.).—Vegetable Cathartic Pills (compound extract of colocynth, 60 Gm.; extract of hyoscyamus, 30 Gm.; resin of jalap, 20 Gm.; extract of leptandra and resin of podophyllum, each 15 Gm.; oil of peppermint, 8 c.cm.; to make 1000 pills). Dose, 1 to 3 pills.

Extractum Colocynthidis Compositum (U. S. P., B. P.).—Compound Extract of Colocynth. Dose, 0.25 to 0.65 Gm. (or gr. iv-x).

Pilulæ Colocynthidis Composita (B. P.).—Compound Pill of Colocynth (colocynth-pulp, 20 Gm.; Barbadoes aloes, 40 Gm.; scammony resin, 40 Gm.; potassium sulphate, 5 Gm.; oil of cloves, 5 c.cm.; and distilled water, q. s.). Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Pilulæ Colocynthidis et Hyoscyami (B. P.).—Pill of Colocynth and Hyoscyamus (compound pill of colocynth, 50 Gm.; extract of hyoscyamus, 25 Gm.). Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Pharmacology.—The peeled, dried fruit of Citrullus colocynthidis (Cucurbitaceæ). Colocynth is gathered when full grown, but still immature, dried and deprived of its rind, the seeds being rejected before using. The plant is a native of western Asia, but cultivated in various portions of the world. The pulp of the fruit after separation of the seeds, which are inert, contains, in proportion of about 2 per cent. of the pulp, a yellow, either amorphous or crystalline, bitter, alkaloidal principle, **Colocynthin,** soluble in water and in alcohol; yielding a resin, **Colocynthein,** when treated by acids, also **Colocynthitin,** insoluble in water and not possessed of purgative effects, a tasteless crystalline body, probably a resin. The seeds contain a fixed oil.

Physiological Action.—In small doses, colocynth acts as a simple bitter, increasing the secretions and improving appetite. In larger doses, it augments the flow of bile and acts powerfully as a drastic and hydragogic cathartic. Overdoses cause gastro-intestinal irritation, griping, and purging. It is generally combined with other drugs to avoid this unpleasant action. Colocynth has some diuretic properties and indirectly acts as an emmenagogue. In excessive doses colocynth has caused death. Less than 4 Gm. (or ʒj) has been known to produce a fatal result, though recovery has occurred in other cases after a considerably larger quantity.

Therapy.—Colocynth is a valuable purgative in chronic constipation or torpidity of the bowels. It produces soft, pulpy stools by stimulating peristalsis. Its griping tendency may be overcome by combining it with aromatics or a small proportion of hyoscyamus or belladonna:—

℞ Extracti colocynth. comp.	4 Gm. or ʒj.
Ext. belladonnæ folior	13 Gm. or gr. ij.
Saponis	65 Gm. or gr. x.
Ol. cajuputi	30 c.cm. or *m*v.

M. et ft. pil. no. xx.
Sig.: Take one or two at night for habitual constipation.

In chronic dropsy of serous cavities, or cerebral congestion, the compound extract may be given with compound licorice-powder. The compound cathartic pills are excellent for cases of *embarras gastrique,* or so-called biliousness. In chlorosis, colocynth is useful with iron. A principle known as **Citrullin,** extracted from colocynth, exercises a stimulant effect upon the abdominal organs and especially upon the intestinal glands. It also acts upon the abdominal and pelvic vessels and nerves and quickens peristaltic

movements. Given in the form of a suppository, citrullin is successful in relieving persistent constipation and, according to G. Archie Stockwell, is of value in hernia when strangulation is threatened. In solution citrullin has also been used as an enema, and Kohlstock reports from the clinic of Professor Senator, of Berlin, that it yielded excellent results. Colocynthin has likewise proved of service, used in the same manner. These substances produce no local irritant effect nor occasion any tendency to constipation. Small doses of colocynth are said to be useful in sciatica, ovaralgia, and other forms of neuralgia.

CONDURANGO CORTEX.—Condurango-bark. Several plants are known as condurango; but the Condurango blanco, or Marsdenia Condurango (Asclepiadaceæ), is that which has the greatest medical interest. The bark is separated from the stem by beating with a wooden mallet, and afterward dried in the sun. It is from one-tenth to one-sixth inch in thickness; its external surface is smooth and of an ashy-gray color. It contains a yellow resin, extractive, tannin, etc. The root contains 2 per cent. of a glucoside, named **Condurangin,** which may be separated into two parts, one of which is soluble and the other insoluble in water. According to Kobert, condurangin is a mixture of at least two glucosides, and Carrara claims to have isolated another glucoside differing from condurangin in solubility. Flückiger also found a small quantity of an alkaloid in condurango-bark. Hager distinguished two principles: (*a*) condurangin, and (*b*) conduranzin, both insoluble in water; also conduransterin, cinnamic acid, and a small proportion of an alkaloid resembling strychnine. A fluid extract may be used, in dose of 4 c.cm. (or f℥j), or a wine, 16 c.cm. (f℥iv).

Physiological Action.—To the resin the effect of the bark is ascribed, as it yields its virtues to alcohol. In the form of a decoction representing 8 or 12 Gm. (or ℥ii-iij), however, it also produces decided therapeutic effect. It has caused diaphoresis, increased secretion of urine, and even vertigo and disturbance of vision, with increased activity of the circulation. Brunton failed to find any therapeutic value in a specimen examined by him.

Therapy. — About a generation ago condurango was brought to the notice of the profession as a specific for cancer, and especially gastric cancer, and reports were published of its wonderful cures in its native habitat. Having failed to fulfill the extravagant claims that were made in its favor, and no other use being then proposed for it, condurango for a time was allowed to retire into obscurity. Some years ago, however, several prominent German clinicians—Ruhle, Binz, Immermann, and Riess—again directed attention to it, claiming that it was a good stomachic tonic; and in a large number of cases presenting symptoms of cancer of the stomach, in which the drug was used, the result was favorable. The remedy was not without success in a single one out of over a hundred cases. This remedy seems to allay the digestive disturbance and pain which accompany organic disease of the stomach. Immermann advises the use of a wine of condurango as a good preparation. The tincture appears to be a valuable remedy in gastric catarrh.

CONFECTIO ROSÆ (U. S. P.).—**Confection of Rose.** (See **Rosa Gallica.**)

CONIUM (U. S. P.).—**Hemlock.**

CONII FRUCTUS (B. P.).—**Conium-fruit.**

CONII FOLIA (B. P.).—**Conium-leaves.**

Preparations.

Fluidextractum Conii (U. S. P.).—Fluid Extract of Conium. Dose, 0.06 to 0.30 c.cm. (or *m*i-v).

Extractum Conii.—Extract of Conium. Dose, 0.03 to 0.12 c.cm. (or gr. ss-ij).

Tinctura Conii (B. P.).—Tincture of Conium (20 per cent.). Dose, 1 to 4 c.cm. (or *m*xv-f3j).

Succus Conii (B. P.).—Conium-juice expressed from fresh leaves and alcohol added (one-third of the volume) to preserve it. Dose, 2 to 7.5 c.cm. (or f3ss-ij).

Unguentum Conii (B. P.).—Conium Ointment (conium-juice evaporated to one-eighth of its volume and three times its weight of wool-fat triturated with it).

Coniina.—Coniine (the active principle). Dose, 0.006 to 0.06 c.cm. (or $m^1/_{10}$-j).

Coniinæ Hydrobromidum.—Coniine Hydrobromide. Dose, 0.005 to 0.65 Gm. (or gr. $^1/_{12}$-j).

Coniinæ Hydrochloridum.—Coniine Hydrochloride.—Dose, the same.

Pharmacology.—The full-grown but unripe fruit of Conium maculatum (Umbelliferæ), carefully dried and preserved, and yielding, when assayed by United States Pharmacopœia process, not less than 0.5 per cent. of coniine. After being kept for two years conium is unfit for use. The British Pharmacopœia also recognizes the fresh leaves and young branches of Conium maculatum collected when the fruit begins to form. By bruising these, pressing out the juice, and adding $^1/_3$ as much alcohol we obtain Succus Conii (B. P.). A tincture of the leaves ($12\ ^1/_2$ per cent.) was formerly official (dose, 2 to 4 c.cm., or f3ss-j), but, like conium-juice, it is unreliable in strength, and should be abandoned in favor of preparations from the seeds. The habitat of hemlock is Europe and North America. It contains three alkaloids and both volatile and fixed oils. The most important is **Coniine** (or **Cynapine**), a colorless, oily liquid, alkaline in reaction, with an acrid, tobacco-like taste and a characteristic odor resembling the urine of mice. Coniine is soluble in alcohol; very slightly in water. It is volatile, and is decomposed by light or heat. It is most abundant in the nearly-ripe fruit of the plant in its second year. **Methyl-coniine,** another alkaloid, is associated with the preceding, and also **Conhydrine,** or **Oxyconiin,** a crystallizable alkaloid, convertible into coniine by abstraction of the elements of one molecule of water. **Paraconiine** has also been isolated.

Another alkaloid has been isolated by Merck. It is believed to be of similar composition to conhydrine, and has, therefore, been termed **pseudo-conhydrine.** It forms easily-soluble salts. Their medicinal effects are less evident than those of coniine.

Physiological Action.—The local effects are sedative in painful conditions. No influence upon secretion has been noticed. Gastric disturbance results from a full dose of conium; nausea and vomiting appear early. Following this, there are staggering gait, weakness of the limbs, numbness, fatigue, ptosis, double vision, pupils slightly dilated, vertigo, lowered respiration, and labored speech. After poisonous doses, there are loss of power of muscles, commencing in the lower extremities; loss of sight and of speech, and, finally, death from paralysis of respiration. Coniine causes paralysis of the phrenic nerve; the motor nerves of the accessory respiratory muscles

become paralyzed later. Very large doses cause general paralysis; but ordinarily the heart's movements seem to be unaffected, and the mind remains clear, until the brain is overcome by accumulation of carbonic-acid gas in the blood.

In a case of hemlock poisoning, the stomach should be emptied and coffee promptly given, with hypodermic injections of atropine. Muscular exercise delays the action of the poison. Free counter-irritation by mustard would doubtless be serviceable. The physiological antagonists are strychnine, physostigmine, and atropine; tannic acid is incompatible. Upon the nervous system methyl-coniine acts slightly differently from coniine; the latter paralyzes the motor nerves from the extremities, gradually extending up to the motor centres; the former affects first the motor columns of the spinal cord. The sensory nerves and muscular irritability remain unaffected. The excretion from the system of coniine is chiefly by the breath and the urine. The use of conium is sometimes followed by an erythematous or papular eruption.

Therapy.—Poultices of the leaves of hemlock and flaxseed (2 parts of the former to 6 of the latter), with boiling water, have been used as a soothing dressing to painful swellings; they should be applied with caution where there are abrasions or ulcers. Conium possesses both anodyne and antispasmodic virtues, and has long been reputed to exercise a deobstruent influence upon glandular and other enlargements. A hemlock ointment, made by bruising the leaves with sufficient water, extracting and incorporating the juice with lard or other excipient, is an efficacious local remedy in painful maladies. It assuages the pain of cancer and may be beneficially spread upon irritable or painful ulcers and painful hæmorrhoids. It likewise affords relief when applied over the seat of pain in neuralgia, herpes zoster, chronic rheumatism, gout, or synovitis. The ointment is appropriately used in order to reduce the volume of enlarged scrofulous glands, enlarged mammary glands, liver, or spleen, and goitre. It may be spread upon the breast when the secretion of milk is excessive or requires suppression. In whooping-cough and asthma hemlock ointment may be applied to the chest to assist the action of other remedies. Conium may be prescribed in form of ointment as follows:—

℞ Extracti conii	4	Gm. or 3j.
Cocainæ Hydrochloridi	32	Gm. or gr. v.
Atropinæ sulphatis	065	Gm. or gr. j.
Veratrinæ oleatis	1 30	Gm. or gr. xx.
Ungt. aquæ rosæ	31	Gm. or ℥j.

M. For neuralgia, chronic rheumatism, gout, and synovitis, a small piece the size of a pea being used for each application.

℞ Extracti conii	4	Gm. or 3j.
Mentholi	32	Gm. or gr. v.
Ext. belladonnæ folior	65	Gm. or gr. x.
Ungt. zinci oxidi, Adipis lanæ hyd. aa	15	5 Gm. or ℥ss.

M. For painful cancer, scrofulous glands, herpes zoster, and enlarged mammary glands.

The vapor of coniine, or the fluid extract with hot water in an inhaler, yields good results in catarrh, laryngitis, irritative cough, and acute bronchitis, or the persistent cough of phthisis. The local hypodermic injection of coniine has been employed in order to quiet the intercostal muscles in

pleurisy and pneumonia; but the hydrobromate, being more permanent, is a better preparation. Other painful and spasmodic diseases have been benefited by the same method. Among these may be instanced angina pectoris, emphysema, asthma, acute mania, and tetanus. Dr. Harley warmly advocates the use of conium in chorea; also in nervous twitchings, blepharospasm, and post-hemiplegic tremor. In various spasmodic affections of children, convulsions, spasm of the larynx, trismus, spasmodic wryneck, and whooping-cough it has also been much approved. In ovaritis and in dysmenorrhœa its administration in the following prescription is frequently followed with great relief from the pain:—

℞ Succi conii	22	c.cm. or f℥vj.
Potassii bromidi	12	Gm. or ʒiij.
Spiritus chloroformi	7.5	c.cm. or f℥ij.
Aquæ camphoræ	ad 240	c.cm. or f℥viij.

M. Sig.: From a half to a tablespoonful every two or three hours.

Conium has been highly recommended in paralysis agitans and hysteria. In acute mania, mania a potu, and active delirium tremens it quiets motor excitement, finding, as it does, its principal usefulness in diseases attended by excessive motor activity. In some cases it is well to combine it with a little morphine for its effect upon the brain, and in others with potassium bromide. Conium has been employed in epilepsy, but here it is inferior to the bromides. It may, however, prove of benefit in those cases marked by vertigo and disturbance of the cerebral functions. Walshe has known it to relieve the pain of gastric cancer. For the latter disease, as well as gastric ulcer, it may be used in this combination:—

℞ Tincturæ conii	2	c.cm. or f℥ss.
Morphinæ sulph.	.065	Gm. or gr. j.
Phenolis liquefacti	.24	c.cm. or *m*iv.
Syrupi acaciæ	90	c.cm. or f℥iij.

M. Sig.: A teaspoonful whenever in pain.

Dr. Seguin, of New York, recommended rapid increase of the dose until physiological effects are noted. He gave 4 c.cm. (or f℥j) of the fluid extract at a dose, and never less than 1.20 c.cm. (or *m*xx). Owing to the very volatile character of the coniine, it is possible to administer large doses of some old fluid extracts without getting any effects whatever. If the strong mousy odor is missing, the preparation will have very little therapeutic value. It is also said that preparations from cultivated plants, such as the succus, or tincture of the leaves, are apt to be inert. This explains the enormous doses used by Dr. Harley (15 to 90 or 120 c.cm., or f℥ss to f℥iii or f℥iv) of the juice. It has been likewise noticed that children bear conium-juice well. Dr. Squibb calls attention to the possible danger following dilution of the fluid extract, by which a precipitate is formed, so that toward the end a poisonous dose may be accidentally taken. Death has been caused by the administration of 9.25 c.cm. (or *m*cl) of the fluid extract. The poison administered to Socrates was apparently a strong, recent infusion of conium.

CONVALLARIA MAJALIS (U. S. P.).—Lily of the Valley.

Preparations.

Fluidextractum Convallariæ (U. S. P.).—Fluid Extract of Convallaria. Dose, 0.18 to 0.30 c.cm. (or *m*iii-v).

The National Formulary also has a fluid extract of the flowers.

Pharmacology.—The official definition is the dried rhizome and roots of Convallaria majalis (Liliaceæ). This plant is a native of Europe, northern Asia, and our Allegheny Mountains. Its rhizome is the size of a quill, its flowers bell-shaped and six-lobed. The flowers possess a fragrant odor and a bitter, acrid taste. All parts of the plant possess medicinal value, but its virtues reside principally in the rhizome. **Convallamarin** is the most important active principle of the plant. It is a bitter-sweet, white, crystalline glucoside ($C_{23}H_{24}O_{12}$), soluble in water and alcohol, but not in ether and chloroform. It is precipitated by tannin, and, by acids, is split up into glucose and **Convallamaretin.** There is also an acrid glucoside, **Convallarin** ($C_{34}H_{62}O_{11}$), which similarly splits up into glucose and **Convallaretin.** The dose of Convallamarin is .03 Gm. (or gr. $^1/_2$).

Physiological Action.—Convallarin, in doses of 0.20 to 0.25 Gm. (or gr. iii-iv), acts as a purgative, but has no marked toxic effect. Convallamarin, in small doses, excites vomiting and manifests a special influence upon the action of the heart. At first the contractions are suddenly retarded and the blood-pressure increased; subsequently the cardiac pulsations are quickened and arterial pressure further augmented. Finally, the beat is arrested. Death may take place within a few minutes after introduction of the poison. The reflex function of the cord is abolished; otherwise the action of the nervous system seems but slightly affected.

Therapy.—In small doses this drug strengthens the heart's action; in larger quantities it restrains excessive cardiac activity. It has been found of especial value in mitral insufficiency. It quickly relieves the dyspnœa and palpitation, and, after having been given for two or three days, may be discontinued for a week or more without recurrence of the symptoms. Convallaria seldom disagrees with the stomach, and no cumulative action has been observed. As a rule, the appetite and digestion seem to improve under its use and a regular action of the bowels is promoted.

Convallaria, and especially convallamarin, have, however, in some instances, been known to cause hæmoptysis, dyspnœa, and other disagreeable symptoms. It increases the secretion of urine, and, when compensation has failed, invigorates the heart and reduces œdema. In disease of the aortic valve, though of some service, the value of convallaria is less marked. In angina pectoris and various forms of functional heart disease this remedy has proved beneficial. The favorable action of convallaria majalis in dropsy of renal or hepatic origin has been announced by Janowski, who prescribes it in an infusion of 4 Gm. (or ʒj) of the plant to 180 c.cm. (or fʒvj) of water, a tablespoonful every two hours, changing later to a 1-to-12 alcoholic tincture, of which 45 to 80 drops are taken during the day. It also favorably influences the diuresis in hepatic cirrhosis. In chronic Bright's disease, it strengthens the circulation, relieves dyspnœa, increases the flow of urine, reduces dropsy, and lessens the albuminuria. Good results have also followed its administration in cardiac debility, due to pneumonia or typhoid fever. In some cases of idiopathic asthma it relaxes the spasm of the arterioles. It sometimes is serviceable in tic douloureux and other forms of neuralgia, insomnia, and in the restlessness of fever. The palpitation and dyspnœa of phthisis are mitigated by the use of convallaria. It is of utility, likewise, in the irregularity of the heart dependent upon acute pneumonia, bronchitis, or emphysema, but is ineffective in fatty degeneration of the heart.

℞ Fluidext. convallariæ ..... 7|5 c.cm. or f3ij.
Syrupi aurantii .....q. s. ad 60 c.cm. or f℥ij.

M. Sig.: A teaspoonful to a tablespoonful three times a day. Useful in mitral insufficiency and functional heart disease.

℞ Potassii bitartratis ..... 15|5 Gm. or ℥ss.
Fluidext. convallariæ ..... 6| c.cm. or f3iss.
Syr. simplicis .....q. s. ad 120| c.cm. or f℥iv.

M. Sig.: From one-half to one tablespoonful, in water, three or four times a day. Valuable in general dropsy from heart or kidney disease.

COPAIBA (U. S. P., B. P.).—**Copaiba.**
Dose, 2 to 4 c.cm. (or f3ss-j).

Preparations.

Oleum Copaibæ (U. S. P., B. P.).—Oil of Copaiba. Dose, 0.30 to 1.20 c.cm. (or *m*v-xx).

Massa Copaibæ.—Mass of Copaiba (copaiba, 94; magnesia, 6 parts). Dose. 0.65 to 2 Gm. (or gr. x-3ss.).

Resina Copaibæ.—Resin of Copaiba. Dose. 0.50 to 1 Gm. (or gr. viii-xv).

Pharmacology.—Copaiba is "the oleoresin of one or more South American species of Copaiba (Leguminosæ)" (U. S. P.), coming principally from Brazil. "The oleoresin obtained from the trunk of Copaifera Lansdorfii and other species of Copaifera" (B. P.). It is not, properly speaking, a balsam. In physical character it is a clear, transparent, oily liquid, of a pale-straw color and a characteristic unpleasant odor and taste. Copaiba is insoluble in water, soluble in alcohol, ether, volatile and fixed oils. It contains a large quantity of volatile oil (the best specimens, 70 to 85 per cent.), in which two resins are dissolved. **Copaivic acid,** the principal one of the resins, is crystallizable, with faint odor and bitter taste; insoluble in water, easily soluble in absolute alcohol and in ammonia. Both the oil and the resin are medicinally active. It gradually thickens on keeping, owing to the conversion of the volatile oil into resin, and crystals of copaivic acid are deposited.

A new substance, termed copaiba-red, has been found by Professor Quincke in the urine of persons taking copaiba. A rose-red, changing to a deeper shade, is produced by heating the urine with concentrated sulphuric acid. The substance upon which this reaction depends is a colorless acid.

Physiological Action.—Locally applied, copaiba is slightly stimulating to the skin and mucous membrane. The taste of copaiba is peculiarly disagreeable, and it imparts its odor to the breath, being partly excreted by the bronchial mucous membrane. It is heating and irritating to the stomach, causing offensive eructations and frequently exciting vomiting and purging. Taken in medicinal doses, it soon interferes with the digestion, causing loss of appetite, disordered bowels, and diarrhœa. Copaiba is very diffusive, and stimulates secretion at its points of elimination by the kidneys, bronchial mucous membrane, and skin. Its special action is upon the mucous membrane of the genito-urinary tract, and in large amounts it gives rise to irritation or inflammation of the kidneys, in its discharge through these organs. Bloody urine, pain in the bladder, and strangury are occasional results of the administration of copaiba. It acts locally upon the genito-urinary tract, at first stimulating and subsequently checking secretions. The resin has a

decided diuretic action and is also expectorant. Georginewski, however, who made numerous experiments upon dogs and rabbits, states that enormous doses of copaiba occasioned, in these animals, only renal congestion, but no inflammation or degeneration. The resin is preferable to the oleoresin, since it is less apt to cause digestive disturbance. Its diuretic effects are powerful, constant, and long continued. The urine gives a precipitate, when treated with nitric acid, which may be mistaken for albumin; but it clears up when heated.

During the administration of copaiba, a coarse, measly rash sometimes breaks out over the body, especially in persons with a delicate skin; it also causes annoying itching. In other cases, urticaria, erythema, or a bullous eruption is caused. The author has observed a rash resembling that of small-pox appear upon all portions of the body. Dr. Frederic Tresillian has observed a case in which a purpuric eruption, accompanied by febrile action, was apparently caused by the administration of copaiba.

The administration with an alkali renders this accident less likely to occur. The mass of copaiba (pilulæ copaibæ, U. S. P. 1870) was introduced to the Pharmacopœia of 1880, but it is less efficient therapeutically than the other preparations, and has been omitted from the present revision.

Therapy. — Copaiba has been used for its stimulating and antiseptic effects in chronic skin diseases, psoriasis, lupus, and leprosy, being in its action very much like gurjun-oil.

Copaiba has been used, with reported advantage, as a local remedy in frost-bites. It can be used with benefit in old ulcers. A mixture of equal parts of copaiba and resin cerate is recommended by Dr. T. G. Stephens, of Sidney, Iowa, as an efficient application to the surface of indolent ulcers.

In thickened and irritable conditions of the tongue, mouth, rectum, vagina, uterus, and the urethra it is also useful. Copaiba, applied to the urethra in gleet, is sometimes followed by a complete removal of the discharge:—

℞ Copaibæ,
Glycerit boroglycerini.....aa 2| c.cm. or f3ss.
M. Sig.: For application to the urethra with bougie or camel's-hair brush.

Internally, it is also given in the treatment of psoriasis, and for this purpose it is best administered in capsules, one or two hours after meals. For bronchitis, given as an expectorant, and in dropsy, for its diuretic effect, it is better to use the resin, which is nearly free from the objection, to the volatile oil, of causing offensive eructations. In bronchitis its effects are more decided after subsidence of the acute stage, and it is particularly valuable in chronic bronchitis associated with dilatations of the tubes and marked by a profuse purulent discharge. In ascites and some kidney disorders the resin is a valuable means of increasing the urine. Copaiba is of service also in cardiac dropsy. The remedy is not, however, invariably successful in removing these transudations, even when the conditions are apparently the same. Ringer concludes that this difference depends upon individual peculiarity, and adds that, whereas copaiba may cause bloody urine, he has seen a large amount of blood in the urine quickly disappear when copaiba was administered. The oleoresin is principally used as an antiblennorrhetic in gonorrhœa, after the acute stage has passed, and in cystitis and pyelitis. It may be given in combination with cubebs, or in the well-known **Lafayette Mixture** (mist. copaibæ comp., N. F.):—

℞ Copaibæ ..... 60| c.cm. or f℥ij.
Tr. lavandulæ co. ..... 60| c.cm. or f℥ij.
Liq. potassæ ..... 15| c.cm. or f℥iv.
Spiritus ætheris nitrosi ..... 60| c.cm. or f℥ij.
Syrupi ..... 150| c.cm. or f℥v.
Mucilaginis acaciæ ..... q. s. ad 473| c.cm. or Oj.

M. To be well agitated when used (4 c.cm. = 0.50 c.cm., or f℥ = *m*viiss). Dose, a tablespoonful taken after meals.

To each dose of the above, 0.18 to 0.30 c.cm. (or *m*iii-v) of oil of sandalwood may often be added, with good results.

Copahin dragees consist of copaiba, 0.32 Gm. (or gr. v); cubeb, 0.65 Gm. (or gr. x); calcined magnesia and sodium carbonate, of each, 0.065 Gm. (or gr. j); made into rather large pills, which are sugar-coated. They have been largely used in the treatment of chronic gonorrhœa.

Among the many combinations of copaiba found of service in gonorrhœa and gleet, the author suggests the following:—

℞ Resinæ copaibæ ..... 14| Gm. or ℥iiiss.
Oleoresinæ cubebæ ..... 4| c.cm. or f℥j.
Phenylis salicylate ..... 12| Gm. or ℥iij.
Pepsinæ pur. ..... 2|60 Gm. or gr. xl.

M. et ft. capsulæ no. xl.
Sig.: From six to ten a day.

℞ Resinæ copaibæ ..... 15|5 Gm. or ℥iv.
Acidi sulphurici arom. ..... 7|5 c.cm. or f℥ij.
Acaciæ ..... q. s.
Infus. rosæ ..... 240| c.cm. or f℥viij.

M. Sig.: A tablespoonful three or four times a day.

℞ Resinæ copaiba ..... 15|5 Gm. or ℥ss.
Fluidextracti glycyrrhizæ ..... 30| c.cm. or f℥j.
Spiritus ætheris nitrosi ..... 15| c.cm. or f℥ss.
Acaciæ ..... q. s.
Aquæ cinnamomi ..... ad 240| c.cm. or f℥viij.

M. Sig.: A tablespoonful three or four times a day.

℞ Olei copaibæ,
Oleoresinæ cubebæ ..... aa 4|60 c.cm. or *m*lxx.
Aloini,
Extracti belladonnæ folior. ..... aa |065 Gm. or gr. j.
Ol. menth. pip. ..... |06 c.cm. or *m*j.

M. et ft. pilulæ no. xij.
Sig.: From three to six pills a day.

It is safe to begin the administration of copaiba in gonorrhœa as soon as the initial severity of the attack has subsided and the bowels have been freely opened. In the chronic cystitis of women Dr. Whitla has derived great benefit from injection into the bladder of equal parts of copaiba and warm castor-oil. One ounce of this mixture is injected and allowed to remain until expelled. Small doses internally administered often prove serviceable in cystitis, and will also often allay irritability of the bladder dependent upon prior attacks of gonorrhœa or excessive venery.

In the gonorrhœa of females an emulsion of copaiba is sometimes used as an injection. In certain affections of the intestinal tract this remedy is

sometimes of service. Chronic diarrhœa and dysentery may improve under the administration of copaiba after other agents have failed. It may prove beneficial in chronic intestinal catarrh accompanied by ulceration, and is recommended by Allingham in chronic proctitis. Clark and others have found it useful in pseudomembranous enteritis, given in the intervals between paroxysms. It has been used successfully in the treatment of hæmorrhoids, 1.20 c.cm. (or gtt. xx) being administered in capsules four times a day, or 2 c.cm. (or f℥ss) in combination with 1 c.cm. (or gtt. xv) of liquor potassæ, taken three times a day. Copaiba has been advantageously given by the mouth in certain inflammatory diseases of the eye, especially iritis and sclerotitis. In purulent ophthalmia it has been applied upon the skin around the orbit and instilled between the lids with good effect.

COPTIS.—The Coptis trifolia, or gold thread (Ranunculaceæ), is a native of the temperate portions of North America and the Old World. The entire plant is used, and was formerly official. The rhizome is thread-like, and of a bright-yellow color. It is bitter to the taste, without odor. Its constituents are **Berberine**, a yellow alkaloid; **Coptine**, a resin; but no tannin.

Physiological Action and Therapy.—Principally on account of the berberine, coptis is a pure, bitter tonic, agreeing well with the stomach, and without astringency. It is used to increase appetite, and as a general tonic. Locally, the infusion has been employed in aphthous ulceration of the mouth, and is a good gargle in ulcerative tonsillitis. The effects of berberine are discussed below.

The East Indian variety, Coptis tecta, of which the root only is employed in medicine, contains a very large proportion of berberine,—more than any other plant known.

A prescription containing gold thread, of much value in the treatment of dyspepsia, especially when attended with diarrhœa alternating with constipation, is:—

℞ Fluidextracti coptidis	60	c.cm. or f℥ij.
Tinct. nucis vomicæ	4	c.cm. or f℥j.
Aquæ cinnamomi	240	c.cm. or f℥viij.

M. Sig.: From one-half to a tablespoonful before meals.

Berberine is an alkaloid found in numerous plants (berberis, coptis, calumba, hydrastis, menispermum, podophyllum, xanthorrhiza, xanthoxylum, etc.), belonging to the natural orders Berberidaceæ, Menispermaceæ, and Ranunculaceæ. It occurs in yellow, prismatic crystals, soluble in hot water and alcohol, but insoluble in ether. It yields bright-yellow, crystallizable salts, of which the hydrochlorate and sulphate are employed in medicinal doses of 0.13 to 0.65 Gm. (or gr. ii-x). It is a bitter tonic, antipyretic, and antiperiodic; also cholagogue. It is useful in dyspepsia, malaria, and diarrhœa. (See also **Berberis.**)

CORIANDRUM (U. S. P.).—**Coriander.**

CORIANDRI FRUCTUS (B. P.).

Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Preparations.

Oleum Coriandri (U. S. P., B. P.).—Oil of Coriander. Dose, 0.06 to 0.30 c.cm. (or *mi*-v).

Confectio Sennæ (U. S. P., B. P.).—Confection of Senna.

Pharmacology.—Coriander is the dried, ripe fruit of Coriandrum sativum (Umbelliferæ). It is a native of Asia. The fruit, or seed, has an agreeable, spicy odor, the chief constituent of which is **Coriandrol,** which is isomeric with borneol. The fruit also contains fixed oil.

Therapy.—This agent is used as an aromatic and stomachic, and is usually employed to prevent griping from other remedies, or as a flavoring excipient. A few drops of the oil may be given upon sugar for the relief of flatulence or colic.

CORNUS.—Dogwood. The bark of the root of Cornus Florida (Cornaceæ), a small tree indigenous to the United States, has decided physiological properties. It contains a crystallizable, bitter principle, **Cornin,** or cornic acid; also tannic acid, resin, etc. As the active principle is altered by air and heat, a decoction or aqueous fluid extract is not an eligible preparation in order to obtain the effect of the drug. Cornin is found also in other species of dogwood: Cornus circinata, Cornus sericea, etc.

Physiological Action and Therapy. — Cornus belongs to the class of vegetable bitters, and is used as a stomachic tonic to increase appetite, etc. It has also considerable reputation for control over malarial manifestations, and is considered the best substitute for cinchona among the native astringent bitters.

CORONILLA.—Coronilla varia (Leguminosæ) is a shrubby plant, the flowers of which are arranged in little tufts resembling coronets. The active principle is a glucoside, which has been termed **Coronillin.**

Physiological Action.—The drug possesses an unpleasant, bitter taste, but it increases the appetite and never excites gastro-intestinal disorders even when given in large doses. Spillmann and Haushalter have studied the effects of coronillin upon the human subject. As a result of their investigations they concluded that coronilla is a cardiac tonic, the beneficial effects of which are manifested within twenty-four to thirty-six hours after ingestion.

Therapy.—In organic affections of the heart coronilla increases the volume of the pulse, augments diuresis, diminishes œdema, and relieves dyspnœa. Coronilla is generally applicable to the same cases in which digitalis also succeeds, and is powerless in those conditions of degeneration in which digitalis fails. It regulates and reduces the action of the heart in tachycardia and abolishes painful reflex manifestations. In lesions of the mitral and aortic valves it is especially beneficial. The paroxysms of dyspnœa dependent upon organic disease of the heart are mitigated by this remedy. A tincture has been used in doses of 2 to 4 c.cm. (or f℥ss-j). Coronilla has no cumulative effect and does not disturb the digestive functions. Coronillin has been given in doses of 0.065 to 0.58 Gm. (or gr. i-ix).

CORYDALIS. — Corydalis, Turkey Corn, the Dicentra Canadensis (Fumariaceæ), a native of the northern part of this country, has some reputation as an alterative, especially used as a tonic in syphilis and other condi-

tions of debility. The tubers are the part of the plant used; they contain an alkaloid, **Corydaline**, combined with **Fumaric Acid**; also an acrid resin and bitter extractive. An alcoholic extract, made by precipitating the resin with water, is incorrectly termed **Corydalia**, or **Corydaline**, by the botanic physicians, and has been given in doses of 0.065 to 0.32 Gm. (or gr. i-v).

COTARNINE HYDROCHLORIDE. (See **Stypticin.**)

COTO CORTEX.—Coto-bark. This bark is obtained from a large tree (fam. Lauraceæ) of Bolivia, but its exact botanical origin is unknown. It is received in the form of flat or curved pieces a foot or more in length and $^3/_4$ inch broad. Externally it is of a cinnamon-brown color, but when broken it appears studded with numerous scattered golden-yellow spots. It has an aromatic odor, which is more perceptible when the bark is bruised. The powder is very irritant to the Schneiderian mucous membrane. The taste is sharp and slightly bitter, but not astringent. The active principle is a crystallizable substance termed **Cotoine**, of a pale-yellow color, slightly soluble in cold water, but soluble in hot water, alcohol, ether, chloroform, and alkaline solutions. Cotoine is precipitated by hydrochloric acid with a clear, yellow color. It is colored blood-red by nitric acid, brownish yellow by sulphuric acid, and black by ferric chloride. Cotoine possesses a rather acrid taste. A bark differing in external appearance from coto, and probably derived from an allied species, has been designated paracoto. **Paracoto** contains an active principle called **Paracotoine**, analogous to cotoine in composition and effects, but feebler. Powdered paracoto is unirritant to the nasal mucous membrane. Paracotoine is of a bluish color, but slightly soluble in boiling water, and is soluble in alcohol, ether, and particularly in chloroform.

Physiological Action.—Applied to the unbroken skin, powdered coto causes heat and redness. Taken internally, it gives rise to a sensation of warmth in the stomach, and in large doses to nausea and vomiting. It stimulates the secretion of saliva. Small doses may increase the appetite. It is eliminated in the urine. Coto retards the development of bacteria and the occurrence of putrefaction. It causes active dilatation of the intestinal blood-vessels. Coto does not produce constipation in healthy individuals.

Therapy.—Coto and paracoto are remarkably efficient remedies in diarrhœa. They are applicable to all varieties of the disorder, except that dependent upon ulcers of the bowel, in which they have generally failed. Abundant testimony exists as to its worth in functional diarrhœa, acute and chronic gastro-intestinal catarrh, cholera infantum, the diarrhœa of typhoid fever, of rachitis, insanity, and in that form resulting from reduced nutrition. It is exceedingly valuable in the treatment of tuberculous diarrhœa.

The author has employed the following prescription in chronic and in tuberculous diarrhœa, the effect being complete cessation of all discharge:—

℞ Fluidextracti coto cort..... 7|5 c.cm. or f℥ij.
Fluidextracti hamamelidis..... 15| c.cm. or f℥ss.
Aquæ cinnamomi .....300| c.cm. or f℥x.
M. Sig.: A dessertspoonful every three or four hours.

Professor Albertoni, to whom we owe the most comprehensive study of the physiological action of coto, observed no favorable results in drunkards

or where the portal circulation was embarrassed, as in cirrhosis. He considers it contra-indicated when there is hyperæmia of the bowel and a tendency to intestinal hæmorrhage.

CRATÆGUS OXYACANTHA.—The English Hawthorn (Rosaceæ) has been introduced into this country from Europe, where it is mostly cultivated for hedges. It has fragrant corymbs of white or purple flowers, and its large thorns make it protective as well as ornamental. The red berries contain tannin, and if gathered before ripening, are astringent. The flowers contain a small proportion of **trimethylamine** (or a substance yielding this principle, and **amygdaline** exists in all parts of the plant. The bark contains **oxyacanthine**, which is not identical with that in Berberis. A normal tincture (dose 0.65 to 1.30 Gm., or *m*x-xx), well diluted with water, has been used principally by botanic physicians in angina pectoris, precordial oppression, and valvular insufficiency.

CREOLINUM.—**Creolin** is obtained from English coal by dry distillation, the carbolic acid being removed, and the residue emulsified by soap or caustic soda, or sulphonated by the action of sulphuric acid. It is a syrupy, dark-brown, or blackish fluid of a tar-like odor. It mixes with water in all proportions, forming an opaque, whitish emulsion. It is soluble in alcohol. The exact chemical constitution of creolin has not been determined, but it seems to consist largely of hydrocarbons joined with cresols free from any trace of carbolic acid, together with a small proportion of organic bases of the pyridin order, and alkaline ash.

Physiological Action.—A 3-per-cent. aqueous dilution excites no irritation when applied to the skin. When the skin is subjected to the action of a 5-per-cent. dilution for a considerable time, a slightly burning sensation results, but soon disappears. Creolin is irritant to mucous membranes. It is an efficient germicide, in some respects more powerful than carbolic acid. It is more destructive than carbolic acid to the micro-organisms of typhoid fever, Asiatic cholera, and suppuration; while, upon dried spores of the anthrax bacillus, carbolic acid exerts a more powerful inhibitory influence than creolin. Carbolic acid is likewise the more efficacious and permanent disinfectant of putrefaction. Creolin possesses the advantage of being much less toxic. It was at first, in fact, supposed to be entirely devoid of toxicity. This claim can be no longer upheld, since several patients, especially among the 2000 midwifery cases reported by Dr. Bitter,[1] of Breslau, showed symptoms of nausea, chill, fever, dyspnœa, collapse, and albuminous urine following its use. In one case, scarlatiniform rash—with thirst, fever, and itching of the skin—was produced.

The application of creolin has also been known to produce eczema, erythema, vesicular eruptions, and desquamation of the skin in large patches, together with more or less severe constitutional disturbance. Dr. Fliesburg has reported a fatal case in a babe, three weeks of age, to whom 2 c.cm. (or *m*xxx) of undiluted creolin had been given by mistake. Death occurred twenty-seven hours after ingestion of the liquid.

Therapy.—It is almost exclusively as a local application that creolin

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[1] *British Medical Journal*, Dec. 13, 1890.

has been used, though it has been administered internally in a few instances with the view of preventing gastro-intestinal fermentative processes. As an efficient and safe antiseptic, it is very advantageously employed in a 1- or 2-per-cent. solution to irrigate accidental or surgical wounds. A 2-per-cent. dilution in olive- or linseed- oil, applied upon absorbent cotton, is an excellent dressing to abscess-cavities, sinuses, to wounds left after resection of bone, removal of a sequestrum, to compound fracture, sloughing ulcers of the leg, etc. In addition to its parasiticide virtues, it is additionally serviceable as a dressing to fresh wounds from its hæmostatic properties, promptly arresting the oozing from divided capillaries. A weak dilution of creolin in water or alcohol makes a good wash in ozæna. Five or 6 drops may be added to a pint of water, or we may follow the method of Moure and prescribe:—

℞ Creolini ..... 1| c.cm. or *m*xv.
Spt. vini rect. .....105| c.cm. or f℥iiiss.
M. A teaspoonful of this solution is added to a quart of tepid water.

Schnitzler has used creolin in diseases of the larynx, especially tubercular, by inhalation (1 part in 1000 of water), by insufflation (from 1 to 5 parts to 100 of sugar of milk), or 1 to 5 parts to 100 of water directly to the diseased parts by mopping. Schnitzler and Kortüm likewise recommend it as a gargle in diphtheria. Applied in the same manner, creolin is useful in tonsillitis. A 1-per-cent. solution has been found curative in thrush and aphthæ. The injection, two or three times a day, of 2 to 4 pints of a $^1/_2$-per-cent. solution has yielded excellent results in dysentery. The same injection is efficacious in serous diarrhœa, colitis, and enterocolitis. In the summer diarrhœa of children and in cholera infantum the solution may be advantageously employed in half strength or less, according to the age of the patient. Given internally, it is reported to have given good results in flatulence and to have succeeded in cases of tænia and oxyuris vermicularis. The offensive odor of cancer is removed by creolin. A 5- to 10-per-cent. creolin-oil is efficient in pediculosis and scabies, or prescribed thus:—

℞ Creolini ..... 2| c.cm. or f℥ss.
Balsam. Peruviani ..... 7|5 c.cm. or f℥ij.
Adipis ..... 31| Gm. or ℥j.
M. Sig.: Apply well over the surface. Use in scabies.

A 1 to 1000 aqueous solution has been used in gonorrhœa. It has seemed much more beneficial in gonorrhœa of women than of men. A 1-per-cent. solution is a very efficacious injection in the cystitis of women.

As a wash in puerperal septicæmia and as an antiseptic vaginal injection before or after labor, a creolin solution is of value. Five or 6 drops to a pint of water have been successfully used in otorrhœa. In extensive burns and in bed-sores Kortüm recommends a 5 to 1000 aqueous solution. A 1- or 2-per-cent. solution is an excellent deodorant and stimulant dressing to leg-ulcers. Rothe[1] has used creolin in the form of an ointment with marked success in the treatment of erysipelas, tinea versicolor, eczema, and in scabies. Obstinate cases of pustular eczema have been cured by the application of creolin-water.

[1] *British Journal of Dermatology*, Nov., 1890.

A 2-per-cent. solution is an admirable disinfectant to the hands of the surgeon. A creolin-soap is also made. The opacity of its watery solution renders creolin inferior to carbolic acid as an immersion fluid for instruments. Moreover, resinous particles are soon deposited upon the instruments, though this drawback has been overcome by the manufacture of vessels having a perforated false bottom upon which the instruments may rest. In the acute gastro-enteritis of children Schwing has obtained satisfactory results from doses of 0.12 to 0.18 c.cm. (or *m*ii-iij) of creolin administered in some demulcent vehicle. The internal administration of creolin has, however, been followed in several instances by decided choleriform manifestations.

The addition of 1 to 2 per cent. of creolin deodorizes iodoform to a very large degree, forming a compound with faint aromatic odor. The creolin may be removed by washing with water.

CREOSOTUM (U. S. P., B. P.).—**Creosote.**
Dose, 0.13 to 1 Gm. (gr. ii-xv).

GUAIACOL. (U. S. P.).—**Guaiacol.**

GUAIACOL CARBONAS (U. S. P.).—**Carbonate of Guaiacol.**
Dose, 0.13 to 1 Gm. (gr. ii-xv).

Preparations.

Aqua Creosoti (U. S. P.).—Creosote-water (1 per cent.). Dose, 2 to 15 c.cm. (or f℥ss-iv).

Mistura Creosoti (B. P.).—Creosote Mixture (creosote, spirit of juniper, aa 1 c.cm., or *m*xv; syrup, 30 c.cm., or f℥j; water, q. s. ad 473 c.cm., or f℥xvj). Dose, 15 to 30 c.cm. (or f℥ss-j).

Unguentum Creosoti (B. P.).—Ointment of Creosote (1 to 9).

Pharmacology.—Creosote is a mixture of phenols and phenol derivatives, chiefly guaiacol and creosol, obtained during the distillation of wood-tar, preferably that derived from the beech, Fagus sylvatica, or Fagus ferruginea. The British Pharmacopœia describes it as "a mixture of guaiacol, creosol, and other phenols, obtained in the distillation of wood-tar." Creosote, therefore, is one of the products of the distillation of wood, separated from tar by fractional distillation. It was discovered in 1830 by Reichenbach. It is largely contaminated or substituted in commerce by a substance obtained from the distillation of bituminous coal, made up of carbolic and cresylic acids principally. Wood-tar cresote is chiefly composed of the following phenols: **Guaiacol, Creosol, Methyl-creosol,** and **Phloral.** The creosote made from beech-wood is of a reddish-amber color; it is the best for medicinal use. It is an oily liquid, nearly colorless; of smoky odor, caustic taste, and neutral reaction; soluble in 150 parts of water, and in all proportions of alcohol, ether, etc. Pure creosote should have a specific gravity of 1067 and distill at a temperature of 200° to 210° C. (392° to 410° F.). It differs from carbolic acid in being less caustic and in not coagulating collodion or albumin and in gelatinizing without crystallizing at a low temperature. It has probably equal, if not superior, antiseptic effects, as seen in its power of preserving meat, from which it derives its name. With the tincture of the chloride of iron, an

alcoholic solution of creosote develops a deep, greenish-blue color; but carbolic acid produces a light brown.

Physiological Action.—Creosote is a local sedative. A strong solution applied to the integument may give rise to erythema, œdema, itching, and pain. Internally, it very closely resembles the effects of carbolic acid as an anæsthetic, antiseptic, and astringent. It escapes from the body by the bronchial mucous membrane in part, and has expectorant powers; it is principally excreted by the kidneys. Both absorption and elimination of creosote occur with marked rapidity. It has been found in the sputum of tuberculous subjects, to whom it had been administered medicinally.

Creosote has a special sedative action upon the nerves of the stomach and allays irritability and nausea. It has a similar effect upon the bronchial mucous membrane when its vapor is inhaled with the vaporizer or steam-atomizer. Dr. Irsai, of Budapest, has demonstrated by experiment that inhalation of creosote and guaiacol gave rise to decided hyperæmia of the lungs. In overdoses creosote causes giddiness, depressed action of the heart, faintness, convulsions, or coma. The antidotes are probably the same as those to carbolic acid, as Hare has announced that the soluble sulphates are efficacious antidotes to creosote poisoning.

Therapy.—As a local anæsthetic, creosote is largely used by dentists in aching teeth with sensitive dentine, and as an application to an exposed nerve-pulp, the remedy being taken upon a little absorbent cotton, and excess removed by allowing it to rest upon blotting-paper before being inserted into the cavity of a tooth, from which *débris* of food or other material should first be removed, by syringing with warm water. Creosote-water has some hæmostatic qualities, and is an antiseptic dressing of value in sloughing ulcers, or for injection into sinuses. In gleet and other catarrhal diseases creosote often acts well when used as follows:—

℞ Creosoti	30	c.cm. or *m*v.
Fluidext. geranii	2	c.cm. or f3ss.
Aquæ rosæ	120	c.cm. or f℥iv.

M. Sig.: Inject night and morning into the urethra,—alone or slightly diluted with warm water.

Creosote is believed to have special value in the treatment of burns and in chilblains. In skin diseases of a scaly character and pruritus creosote is a useful application; and in erysipelas the ointment is of benefit in relieving the pain and reducing the inflammation. This ointment relieves the itching and burning of erythema multiforme and eczema, and is beneficially applied to ulcerated surfaces and psoriasis. Creosote ointment is very advantageously prescribed in connection with lead carbonate, as:—

℞ Plumbi carbonatis	4	Gm. or 3j.
Unguenti creosoti (20 per cent.)	31	Gm. or ℥j.

M. For erysipelas, erythema, acute eczema, and burns.

A gargle containing creosote, in ulceration with sloughing of the mouth or throat, purifies the breath and stimulates the ulcer to repair.

In laryngeal diphtheria, coincidently with the administration of antitoxin, Dr. William Ewart, of London,[1] advocated the use of creosoted oil (1 to 20, olive-oil) for the expulsion of tracheal false membranes. He prac-

[1] *British Medical Journal*, May 28, 1898, p. 1381.

tices early tracheotomy for laryngeal diphtheria, and then, in order to promote loosening, separation, and expulsion of the membranes, he injects into the trachea 1 c.cm. (or *m*xv) of the creosoted oil every two hours, but on the third day every four hours. After recovery from diphtheria, the systematic use of a spray of creosote in liquid petrolatum-oil (1 to 60) to limit infection, is a valuable expedient. This is also used with advantage in various chronic forms of rhinitis, ozæna, etc.

For catarrhal laryngitis and tubercular disease of the air-passages, creosote can be sprayed over the surface as in this prescription:—

℞ Creosoti ..... 4| c.cm. or f3j.
Tinct. benzoin. co. ..... 7|5 c.cm. or f3ij.
Aquæ hamamelidis dest.,
Glycerini ..... aa 45| c.cm. or f℥iss.
M. Sig.: Use in an atomizer. Spray over the surface three or four times a day.

It is inadvisable to make use of the spray if a tendency to pulmonary hæmorrhage is present. Dr. John Dunn, of Richmond, Va., uses in atrophic rhinitis:—

℞ Ol. anisi,
Creosoti ..... aa 1|20 c.cm. or *m*xx.
Petrolati ..... 31| Gm. or ℥j.
M. Sig.: Introduce a small piece within the nostril.

Taken into the stomach, it checks fermentation and reduces irritability, allaying nausea and correcting the causes productive of diarrhœa. In fermentative dyspepsia the following combination is recommended by Dr. B. W. Richardson:—

℞ Creosoti pur. ..... |75 c.cm. or *m*xij.
Alcohol. dilut. ..... 75| c.cm. or f℥iiss.
Ammon. benzoat. ..... 8| Gm. or 3ij.
Glycerin. pur. ..... 22| c.cm. or f3vj.
Infus. caryophylli ..... 180| c.cm. or f℥vj.
M. Sig.: Tablespoonful two or three times a day, between meals, in water.

Vladimiro de Holstein[1] finds in creosote an excellent means of combating chronic constipation, without exercising any purgative action properly so called. The creosote should not be prescribed in pills, capsules, or alcoholic solutions, but pure and in drops. The effective dose is about 7 or 8 drops taken twice daily, immediately after breakfast and after dinner, in a glass of milk, beer, wine and water, or pure water. To begin with, 1 drop of creosote is administered, and that amount increased by 1 drop daily until the desired effect is obtained. In this way the necessary dose is determined for each case individually. This treatment has to be continued for some time, some months in fact, and not only overcomes the chronic constipation, but at the same time restores the appetite and braces up the system. Under its influence the stools become regular, bland, and copious, and free from pain or any sign of intestinal irritation.

It is a useful remedy in seasickness and the vomiting of pregnancy, and in the summer diarrhœa of adults as well as of infants.

In obstinate vomiting of pregnancy Kaatzer prescribes:—

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[1] *Cronica Médica*, May 15, 1899.

℞ Creosoti pur. ..... 2| c.cm. or f3ss.
Alcoholis ..... 30| c.cm. or f3j.
Tr. gentian. co.,
Fluidext. coffeæ viridis..... aa 9|25 c.cm. or f3iiss.
Aq. destillat. ..... 90| c.cm. or f3iij.
M. Sig.: To be well shaken. Dose, teaspoonful two or three times a day in milk.

Creosote has given good results in the treatment of intestinal hæmorrhage, gonorrhœa, and gleet. In seasickness the nausea and vomiting may be overcome by this combination of creosote:—

℞ Creosoti ..... |30 c.cm. or *m*v.
Morphinæ sulphatis ..... |065 Gm. or gr. j.
Aquæ menth. pip. ..... 90| c.cm. or f3iij.
M. Sig.: A teaspoonful every two or three hours until relieved.

In chronic bronchitis, bronchorrhœa, and phthisis creosote has been given with marked benefit, especially where cavities have formed, as in the following combinations:—

℞ Creosoti ..... |06 to |18 c.cm. or *m*i-iij.
Tr. gentinæ comp. ..... 2| c.cm. or *m*xxx.
Spiritus frumenti ..... q. s. ad 7|5 c.cm. or f3ij.
M. Sig.: Take four times daily.

℞ Creosoti,
Tinct. capsici ..... aa 4| c.cm. or f3j.
Syrup. acaciæ ..... 30| c.cm. or f3j.
Syrup. limonis .....120| c.cm. or f3iv.
M. Sig.: A teaspoonful with water after meals.

℞ Creosoti ..... 2| c.cm. or f3ss.
Syrup. ferri iod.,
Glycerini ..... aa 90| c.cm. or f3iij.
M. Sig.: A teaspoonful in water three or four times a day.

A combination employed by Professor Bouchard in the treatment of pulmonary tuberculosis is:—

℞ Creosoti ..... 4| c.cm. or f3j.
Balsam Tolutani ..... 7| c.cm. or f3i $^{3}/_{4}$.
Terebinthinæ ..... 1| Gm. or gr. xv.
Acid. benzoici ..... q. s.
M. et ft. pil. no. lxxx.
Sig.: Ten pills to be taken daily.

Creosote may be given in a pill, or the prescribed number of drops added to a teaspoonful of old Jamaica rum, diluted with water. In a considerable proportion of cases, cough and expectoration are diminished and fever and night-sweats are lessened. It is also given in tuberculosis by hypodermic injection. P. Carles recommends for hypodermic injection a mixture consisting of 10 parts of beech-wood creosote, 80 parts of tincture of quillaja, and 60 parts of distilled water. The creosote is said to be dissolved by aid of the saponin, and not merely suspended. The liquid is thought to be better adapted to the purpose than the ordinary emulsions of creosote. It can be diluted to any extent with either cold or warm water. Dr. G. Bell is in the habit of prescribing creosote with compound fluid extract of cinchona and administering it diluted with milk. Creosote has also been administered with some success to consumptives in the form of a rectal

injection. It is stated to have been well tolerated by the bowel, that it reduced fever, and in some cases arrested diarrhœa. The taste of creosote was perceived in the mouth in a few minutes after the injection had been made. Another evidence of rapid absorption was the occasional occurrence of green or dark-colored urine.

In the treatment of tuberculosis, cresote is, according to Jacobi, the most valuable drug which we possess. Sommerbrodt, who introduced this method of therapy, was accustomed to increase the dose rapidly until the point of tolerance had been attained. He generally gave the remedy mixed with codliver-oil or olive-oil, and inclosed in a capsule. Under the influence of creosote the bacilli may disappear from the sputum and the physical signs improve. In conjunction with its internal employment, Dr. Beverley Robinson, of New York, recommends frequent and prolonged inhalation of the drug. Inhalations often improve the condition of the larynx and relieve an obstinate cough. The administration of creosote by inhalation in combination with oil of peppermint, according to Carasso, causes disappearance of tubercle bacilli from the sputum. According to Sommerbrodt, the earlier the creosote treatment is adopted in tuberculosis, the more favorable are the results. He has used it also with advantage in scrofula. M. Burlureaux ascribes prognostic value to creosote in tuberculosis. The cases in which it is not well borne are, as a rule, beyond hope. Patients by whom it is tolerated are generally improved. Dr. F. Velten reports excellent results from the use of creosote in tubercular pleurisy with effusion. The effusion, fever, and other symptoms of pleurisy gradually disappeared.

Mr. Charles Lamplough[1] thus sums up the results of his observations on one hundred cases of pulmonary tuberculosis treated with large doses of beech-wood creosote:—

1. The best beech-wood creosote can be given with benefit, in amounts varying from 7.5 to 15 c.cm. (or *m*cxx-ccxl) daily, in cases of pulmonary tuberculosis.

2. The drug is best administered in codliver-oil or in a spirituous solution, and in some cases the "creosote chamber" or oro-nasal inhaler may be ordered in addition, with advantage.

3. The dose should be small at first, but it can be rapidly increased to 2.50 c.cm. (or *m*xl) three times daily for an adult. In three cases doses of 2 c.cm. (or *m*xxx) three times a day were well borne by children.

4. Large doses rarely cause any gastric disturbance; on the contrary, the appetite is frequently increased, symptoms of dyspepsia disappear, and codliver-oil is more easily assimilated. The cough, expectoration, and night-sweats are diminished, and the physical signs improved.

5. Owing to its disinfectant action in the alimentary canal, the drug probably diminishes the risk of tuberculous enteritis by self-infection when patients swallow their sputa; but, owing to the increased peristalsis which is created by creosote, it is usually contra-indicated in cases where the ulceration is already advanced.

6. The drug does not tend to cause hæmoptysis, but rather to prevent its recurrence.

7. Creosote does not irritate the normal mucous membrane of the genito-urinary tract.

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[1] *British Medical Journal*, May 28, 1899.

8. Owing to its extremely small cost, pure creosote can be given to a much larger number of patients than the carbonates of creosote and guaiacol, which, respectively, cost four times and twelve times as much as the older drug.

Dr. G. Bell derived decided benefit from the administration of creosote in a severe case of perinephritis. In cases of suppurating glands, also, he has witnessed good results from its use, and suggests that it may act as a preventive of possible tubercular infection. This writer believes, moreover, that it is of advantage in pyæmia.

Dr. Charles Eloy, of Paris, recommends creosote to be given in emulsion, as follows:—

℞ Ol. amygdal. dulc. .....150| c.cm. or f℥v.
Creosoti ..... 7|5 c.cm. or f3ij.
Misce et adde:—
Pulv. acaciæ ..... 81|5 Gm. or ʒii3v.
Aq. menth. pip. .....473| c.cm. or f℥xvj.
M. Sig.: From two to five tablespoonfuls a day.

Seitz prefers to combine creosote with codliver-oil, and makes an emulsion with the aid of saccharin. Both creosote and guaiacol have been injected beneath the skin or into the lung. Creosote affords relief in flatulent dyspepsia, sarcina ventriculi, and gastralgia. It can be prescribed, in the diseases just referred to, as follows:—

℞ Creosoti ..... |30 c.cm. or *m*v.
Tinct. capsici ..... 2| c.cm. or f3ss.
Aquæ sodæ menth. ..... q. s. ad 90| c.cm. or f℥iij.
M. Sig.: A teaspoonful in water at meals.

℞ Creosoti ..... |37 c.cm. or *m*vj.
Glycerini,
Syr. acaciæ ..... aa 45| c.cm. or f℥iss.
M. Sig.: A teaspoonful before meals.

Creosote has been successfully employed in diabetes mellitus by P. Valentin, who gave it in daily doses of 4 drops, increased gradually to 10 drops. The sugar soon disappeared, and did not return even when a diet containing starch and sugar was allowed. Similar results have been reported by Audubert. Good effects have been obtained from creosote in typhoid fever, diphtheria, scarlet fever, and erysipelas. A. Atkinson has found it efficacious in the treatment of tape-worm. A mixture of creosote, spirit of chloroform, and tincture of lavender may be used in an inhaler in diseases attended with profuse, bad-smelling expectoration. This mixture, or those of similar composition, all prove of great value in removing the offensive odor of gangrene of the lung in phthisis, laryngitis, chronic bronchitis, and also in asthma:—

℞ Creosoti,
Ethyl iodidi,
Terebeni..... aa 4| c.cm. or f3j.
M. Sig.: For inhalation. Ten to twenty drops in an inhaler when necessary.
℞ Creosoti,
Eucalyptolis,
Terebeni..... aa 4| c.cm. or f3j.
M. Sig.: For inhalation. Ten to twenty drops, as necessary.

℞ Creosoti,
Thymoli,
Alcoholis ..... aa 4| c.cm. or f3j.

M. Sig.: For inhalation. Ten to twenty drops.

Koch's method of treating erysipelas, consists in applying the following ointment, spread evenly with a camel's-hair pencil, in a thin layer over the affected part:—

℞ Creosoti vel creolini..... 4| c.cm. or f3j.
Iodoformi ..... 15|5 Gm. or 3iv.
Adipis lanæ hyd. ..... 38|8 Gm. or 3x.

M. After applying the ointment as directed, cover the surface with a thin sheet of gutta-percha or rubber cloth.

Dr. Soupault recommends the administration of creosote in full doses after tracheotomy in diphtheria, and also the application externally over the tube of a 1-to-30 solution in alcohol and glycerin. Dujardin-Beaumetz speaks of a patient who was at once tuberculous and leprous, and in whom rapid amelioration was produced by hypodermic injections of creosote. The anæsthetic patches of lepra, which had been utilized in inserting the needle, had almost entirely disappeared. Creosote, in doses of 0.03 c.cm. (or *m*ss) and upward three or four times a day, has been recommended in the treatment of whooping-cough, and has been employed in the laryngeal and bronchial manifestations of influenza. Vehsmeyer made use of creosote in a case of typical leukæmia in a nine-month-old child. The spleen diminished in volume and the mucous membrane gained some color and, after some months, the blood had become almost normal. The child subsequently died of convulsions, but, in view of the general amelioration, it is suggested that further experiment should be made with the drug in the case of adults.

Guaiacol (U. S. P.).—Creosote contains from 60 to 90 per cent. of **Guaiacol**, which is a colorless liquid, sparingly soluble in water, but very soluble in ether, alcohol, and fatty oils. It is more agreeable in odor and taste than creosote, and is said to be better borne. It improves the appetite and digestion and prevents or relieves flatulence. It is probably eliminated by the lungs, exerting a directly local beneficial action. Guaiacol is usually given in single doses of 5 drops, or in daily quantities of 20 to 40 drops. Sahli has proposed that it should be employed instead of creosote in the treatment of phthisis. It indirectly reduces hectic fever and checks night-sweats. When given at an early stage of the disease, the bacilli diminish remarkably in number and may even entirely disappear. Labadie-Lagrave has advantageously prescribed guaiacol in the form of pearls or capsules. Bourget, of Geneva, prescribes it dissolved in wine or codliver-oil.

Continued experiment in the laboratory, however, has shown that ordinary liquid guaiacol is not a chemically-pure product, but a mixture, in varying proportions, of guaiacol, creosote, and cresylol. The actual proportion of guaiacol present in different samples varied from 10 to 50 per cent. The variation in composition may explain the untoward results which have been reported, where prostration or collapse followed the application to the surface of the skin of 1.20 to 2 c.cm. (or gtt. xx-xxx), of guaiacol. M. Ferrand said that he had seen accidents produced with a cubic centimetre of guaiacol. Local anæsthesia may be produced sufficient for small surgical

operations by injecting 0.045 c.cm. (or *m* $^{3}/_{4}$) dissolved in olive-oil (1-20) hypodermically, although a much larger quantity might be used without danger. Pure guaiacol has been synthetically prepared, and occurs in the form of colorless rhomboidal crystals, almost insoluble in water, soluble in alcohol, oil, and anhydrous glycerin. Its taste is somewhat sweet, but is followed by a pungent and burning after-taste. MM. Gilbert and Maurat observed that the principal effects of poisoning with pure guaiacol were enfeeblement and retardation of the heart's action and the breathing. Most of the secretions were augmented, and especially that of the lacrymal gland. At the moment of death, which takes place under coma, the temperature may fall as low as 68° F.

Liquid guaiacol has been given in enema, and its vapor has been inhaled. It has also been introduced into the system by subcutaneous injection in the daily dose of 0.50 to 1 c.cm. (or *m*viii-xv). Professor Peter speaks favorably of the use of the drug hypodermically, but adds the caution that its effects must be carefully watched, as it is capable of causing hæmoptysis, pneumonia, acute phthisis, and fat-embolism. Signs of evil import are the production of a persistent bad taste in the mouth, a dark-colored urine, and a marked rise or fall of temperature. Injections of guaiacol have yielded good results in fetid bronchitis, chronic bronchitis, and bronchial dilatation. In lupus, Dr. Moreau, of Tours, advises the hypodermic injection twice weekly of a solution of guaiacol and thymol in sterilized olive-oil. The mixture which he employs contains 2 Gm. (or gr. xxx) of thymol in 45 c.cm. (or f℥iss) each of guaiacol and sterilized oil. Of this preparation 1 c.cm. (or *m*xv) are at first injected and the quantity is gradually increased to 3 c.cm. (or *m*xlv). The injections are followed by considerable local and general reaction. After six or seven injections had been given, the nodules generally underwent retrocession and ulcers cicatrized. The treatment may produce serious symptoms, and is scarcely suitable for use when pulmonary or cardiac lesions are present. The injections are painful. A combination of guaiacol and thymol iodide was also used, but was abandoned as being more painful than the mixture with thymol. In fistula of the anus, Dr. Charles C. Allison recommends injection of guaiacol with sweet almond-oil.

Guaiacol is readily absorbed by the skin, and it has been found that a local application has the power of reducing febrile temperature. The remedy is painted upon an area varying in size from 4 to 20 square inches and prevented from evaporating by being covered with an impermeable dressing. This method has been made use of in tuberculosis, erysipelas, pneumonia, articular rheumatism, scarlatina, and typhoid fever. The reduction of temperature is accompanied by free perspiration. The quantity employed was, as a rule, 2 c.cm. (or *m*xxx). The application gave rise to no depression of the circulation or respiration, albuminuria, or other evidence of renal irritation, although it is advised to watch the kidneys. Prof. J. M. Da Costa believed that the local application of guaiacol is of advantage where the cold-bath treatment is impracticable or where there is a tendency to intestinal hæmorrhage. The applications have been made upon various portions of the integument without any noticeable difference of result. They occasioned increased diuresis.

Drs. Friedenwald and Hayden reported[1] a series of seventeen cases in

[1] *New York Medical Journal*, April 14, 1894.

which guaiacol was thus applied; among which were pneumonia, typhoid fever, pulmonary tuberculosis, malarial fever, influenza, rheumatism, and erysipelas. A powerful antipyretic action was observed in these cases. Dr. Ferrand uses equal parts of guaiacol and glycerin in allaying the pain of sciatica and the chest-pains of tuberculosis. Compresses wet with guaiacol (15 to 30 drops) will give almost immediate relief in neuralgia. Sabattain (Practitioner, February, 1896) recommends:—

℞ Mentholis,
Guaiacol, ... aa 1| Gm. or gr. xv.
Alcoholis (abs.) ..... |20 c.cm. or ʒv.
M. To be painted on the skin; not more than a drachm to be used at one time.

Malderesco uses applications of guaiacol to the thorax posteriorly, corresponding to the area of lung involved, with good results, in pulmonary tuberculosis. In bronchiectasis the employment of guaiacol-vapor baths has produced remarkable improvement, greatly diminishing the quantity of the greenish expectoration and causing the breath to become odorless, as in a case reported by G. H. Parry.[1] Professor J. M. Anders has used it hypodermically in sciatica and supra-orbital neuralgia, 2 drops of guaiacol being mixed with 10 drops of chloroform. He has given it internally with benefit in gastralgia. The absorption of pleural effusions is, according to Sigalea, promoted by painting upon the surface once daily for several days a mixture thus composed:—

℞ Guaiacol. ..... 3| c.cm. or *m*xlv.
Glycerin.,
Tr. iodi ..... aa 18|5 c.cm. or fʒv.—M.

Paintings of guaiacol have been found by Balzer and Lacour to be beneficial in orchitis, relieving pain and reducing temperature. The drug was used undiluted upon the inguinal region, but upon the scrotum it was applied in the form of an ointment containing from 2 to 5 c.cm. (or *m*xxx-lxxv) to the ounce. Commercial guaiacol is often contaminated with cresylol and cresol, and for this reason Drs. A. Gilbert and L. Maurat prefer the chemically-pure, synthetic guaiacol, which is in white, rhombohedral crystals, insoluble in water, but soluble in glycerin, alcohol, and oils. Allen McLane Hamilton administers guaiacol in insanity, as an intestinal antiseptic, to prevent the formation of toxins. In cystitis the use of a 20-per-cent. solution of guaiacol, in sweet oil (0.06 to 0.12 c.cm., or *m*i-ij, being injected daily), is advocated by Cohn as being more of a local anæsthetic than pure guaiacol.

Dr. S. Solis-Cohen believes that the application of guaiacol to the throat has a prophylactic power against diphtheria. He employs a mixture of 10 parts of guaiacol, 1 part of menthol, and 10 parts of olive-oil.

In tubercular ulceration of the larynx, P. Watson Williams advocates curettement, followed by the application of lactic acid, followed by pure guaiacol, and the use of a 20-per-cent. spray.

Professor Schueller administers guaiacol stirred into some salt water, milk, or soup, or, for adults, in a glass of wine, preferring this method to the exhibition in pills or capsules. In many instances he gives it by inhalation, weak aqueous solutions (5 to 3000 or 5 to 5000) being employed. He has

[1] *The Lancet*, July 22, 1899.

obtained good results from guaiacol, not only in pulmonary tuberculosis, but in lupus, hip-joint, and Pott's disease.

M. Picot has met with very encouraging results from the hypodermic injection of a mixture of guaiacol and iodoform. As an excipient he employs sterilized olive-oil and vaselin, each c.cm. (or *m*xv) of the base containing 1 cg. (or gr. $^1/_6$) of iodoform and 5 cg. (or $m^5/_6$) of guaiacol. This combination is modified by M. Pignol, who adds 14 cg. (or gr. ii $^1/_3$) of eucalyptol to each c.cm. and omits the vaselin from the base. Dr. R. Robertson approves of this method of treatment in empyema, provided that free drainage is maintained. Dr. William H. Gregg recommends the administration of guaiacol in the form of an enema.

Dr. Clemens has observed improvement in diabetes mellitus from the use of 1.20 to 2 c.cm. (or *m*xx-xxx) of guaiacol thrice daily, suspended in milk or codliver-oil. The polyuria was markedly restrained, the general condition was improved, and, after four weeks of treatment, the patients could partake of some saccharine foods without increasing the glycosuria.

Guaiacol Carbonate (U. S. P.).—This substance is a fine, crystalline powder, devoid of taste or smell, insoluble in water, slightly soluble in cold alcohol; soluble in hot alcohol, ether, and chloroform; slightly soluble in glycerin and fatty oils, the average dose in which this compound is given being 0.65 Gm. (or gr. x), which may be gradually increased to 2 to 6 Gm. (or gr. xxx-xc) per day. It has been used by Seifert and Koelescher in a number of cases of tuberculosis. These authors state that it causes no irritation of the gastro-intestinal mucous membrane, that it passes through the stomach unchanged, and is decomposed in the intestine into guaiacol and carbonic-acid gas. According to de Grazia and Casaretti, this decomposition may take place in the stomach in the presence of fermentation. Seifert and Koelescher witnessed improvement as regards cough, appetite, and nutrition in consequence of its employment. They administered 6 Gm. (or ʒiss) of the drug in divided doses during the twenty-four hours. Guaiacol carbonate has also been given with advantage in typhoid fever by Dr. F. Hölscher, who remarked that it produced a moistening of the tongue and an improvement in the character of the stools. The remedy had a favorable influence upon the bronchitis which accompanied the fever, disinfected the bowel, and generally prevented extreme prostration and severe cerebral symptoms. He gave the drug in the dose of 1 Gm. (or gr. xv) night and morning. In bladder-disease or chronic cystitis, Colin recommends guaiacol carbonate dissolved in olive-oil (20 per cent.); 0.06 to 0.13 Gm. (or gr. i-ij) being injected into the bladder twice daily. It acts as a local anæsthetic and antseptic.[1]

Dr. F. C. Simpson, of Louisville, reports excellent results from the employment of guaiacol carbonate in intestinal troubles due to neurasthenia.

Guaiacol Phosphite.—This is a definite chemical combination, first prepared by M. Ballard, and which promises to prove of therapeutical efficacy. It is a white, crystalline powder, of a warm taste, but not caustic. The compound is very soluble in alcohol, ether, water, chloroform, and fatty oils; slightly soluble in turpentine and glycerin. It contains 92.25 per cent. of guaiacol and 7.75 per cent. of phosphorus. Daily doses of 4 to 6 Gm. (or ʒi-iss) were given to dogs without evil consequences; but 15.5 Gm. (or ʒss)

[1] *Journal de Médecine*, Jan. 26, 1906.

caused coma and death a few hours after administration. From 10 to 12 Gm. (or ʒiiss-iij) for a man seemed to be a maximum safe dose.

Benzoyl-guaiacol, or Benzosol, is a crystalline powder, destitute of odor or taste, insoluble in water; soluble in ether, chloroform, and hot alcohol. It is a compound of benzoic acid and guaiacol. It is split up in the bowel into its constituents. It is well borne even in large doses. It diminishes cough, expectoration, and râles; but has no effect upon the bacilli. Benzoyl-guaiacol may be prescribed in the dose of 0.25 Gm. (or gr. iv) three times a day, or daily doses of 1 to 5 Gm. (or gr. xv-lxxv). Benzoyl-guaiacol, known also as benzosol, may be given with chocolate and sugar. According to the clinical experiments of Professor Rummo, corroborated by those of de Grazia and Casaretti, benzoyl-guaiacol is the most efficient *succedaneum* of creosote or guaiacol.

Other salts or compounds of guaiacol have been prepared, as guaiacol cinnamate (cinnamyl-guaiacol, or styracol), guaiacol salicylate (guaiacol salol, or salicyl-guaiacol), etc.

Guaiacol-di-iodide.—This compound is obtained from sodium-guaiacol by the action of iodine and potassium iodide. It is a reddish-brown salt and possesses an odor similar to that of iodine. It is soluble in alcohol and fatty oils, but rapidly decomposes. Guaiacol-di-iodide is given in the same doses and for the same purposes as guaiacol.

Guaiacol Salicylate.—This salt occurs in the form of white crystals, free from odor, soluble in alcohol, insoluble in water. Its dose and therapeutical applications are the same as those of salol.

Creosote Carbonate, or **creosotal,** is an amber-colored, clear, neutral, oily liquid, of a sweetish taste, without odor. This compound contains 90 per cent. of creosote. At ordinary temperatures it is viscid, but is easily liquefied by moderate heat. It is not irritating to mucous membranes and is stated to be much less toxic than creosote. Creosote carbonate is insoluble in water, glycerin, and weak alcohol. It is soluble in all proportions in 95 per cent. alcohol, in ether, chloroform, and soluble in 4 or 5 parts of cod-liver-oil or olive-oil. In the bowel it is separated into creosote and carbonic acid. It is said to improve the appetite and effect a gain in weight and strength. It can be administered in capsules, dissolved in codliver-oil, or made into an emulsion with the yolk of an egg, diluted with water, sweetened, and flavored. Professor van Leyden [1] reports a specific action of creosotal in phthisis, and cases are reported showing complete tolerance of the remedy by the digestive organs and great improvement in the local symptoms and general health. After six to eight months' treatment, in some cases, all the evidence of pulmonary disease disappeared. Very favorable reports of the usefulness of this agent in acute pneumonia have appeared. Leonard Weber, of New York, reported 9 cases, and H. W. Cummings, of Hearne, Texas, 20 cases, without a death. Dujardin-Beaumetz also reported very favorably upon this drug. It has the exceptional advantage of being a remedy of a price within the reach of the poor. The dose is 0.30 c.cm. (or *m*v) three times daily, increasing the dose of 0.18 c.cm. (or *m*iij), until 1.65 c.cm. (or *m*xxv) are taken at a dose. When marked improvement has taken place the remedy can be gradually reduced to 0.60

[1] "Charité Annalen," Berlin, 1897.

c.cm. (or *m*x) three times a day. After a few weeks the ascending scale can be again begun.

Creosote Calcium Hydrochlorophosphate.—Under this cumbrous designation a mixture of creosote carbonate and dry calcium hydrochlorophosphate has been used in phthisis and scrofula. The mixture is a white, syrupy mass and is administered in emulsion in the dose of 0.03 to 0.12 c.cm. (or *m*ss-ij) twice a day.

Oleocreosote.—An oleic ether of creosote, obtained by the interaction of oleic acid and creosote, is preferred by some authorities as being tolerated in larger doses than a simple mixture of creosote and oil.

It is of a yellowish color and oily consistence, and contains 33 per cent. of creosote; is insoluble in water, slightly soluble in alcohol; but dissolves in ether, chloroform, and fatty oils. Oleocreosote is comparatively devoid of caustic properties and is well borne by the stomach.

Styracol is prepared by heating together guaiacol and cinnamyl chloride and occurs in the form of crystalline needles, without color and practically insoluble in water. Styracol has been used as an intestinal antiseptic and in gonorrhœa, chronic cystitis, and pulmonary tuberculosis. As a local application it has been employed to promote healing of wounds and ulcers.

CRESOL (U. S. P.).—**Cresol** (C_7H_7OH).

Preparation.

Liquor Cresolis Compositus (U. S. P.).—Compound Solution of Cresol. (Cresol 5 per cent. in linseed-oil soap).

Pharmacology.—Crude carbolic acid consists largely of cresols. These are insoluble in water on account of the admixture of other hydrocarbons. When separated from the latter the cresols present themselves in the form of a clear fluid of a pleasant odor. This liquid is a combination of three isomeric modifications: ortho-, meta-, and para- cresol. Cresol (U. S. P.) is a mixture of the three isomeric cresols obtained from coal-tar, freed from phenol hydrocarbon, oils, and water. It should be preserved in amber bottles, protected from light. It is soluble in 60 parts of water at 77° F. or 25° C. Its specific gravity at 68° F. varies between 1.042 and 1.049, and its boiling-point is between 365° and 401° F. Professor Charteris found that moderately toxic doses produced in guinea-pigs convulsions of the hind-legs. Large doses immediately gave rise to severe convulsions involving the whole body. A lethal dose for the guinea-pig appeared to be from 0.43 to 0.50 c.cm. (or *m*vii-viij). Bacteriological experiments demonstrated that cresol has nearly three times more germicidal power than pure carbolic acid. A 1-per-cent. aqueous solution of cresol has been found an efficient cleansing application to wounds and an excellent fluid for the disinfection of instruments.

Therapy.—Dr. Robert Lee observed that cresol, when mixed with water in definite proportion, will, like carbolic acid, yield, on boiling, a vapor of definite and constant strength. By virtue of this property the fluid may be beneficially administered by inhalation in many diseased conditions of the upper air-passages. Dr. Granville Macgowan[1] has found this agent to have especial value in treating alopecia areata, one or two applications being sufficient for a cure. It is also a valuable remedy for the

[1] *Journal of Cutaneous and Nervous Diseases*, May, 1899.

treatment of ring-worm, pityriasis, and other parasitic affections. Cresol has been used as an internal remedy by Dr. H. Kölsch, who reported excellent results from its use in twelve cases of typhoid fever. These were treated by cresol exclusively. Alleviation of the malady was marked. No complications or relapses occurred, and convalescence was rapid. In six of the cases in which cresol was employed from the earliest days, the course of the disease is said to have been shortened.[1]

Creosal.—This is a compound of creosote and tannic acid, a brown, hygroscopic powder; soluble in water, alcohol, and glycerin; insoluble in ether; an astringent and antiseptic. It has been given in daily doses of 3 Gm. (or gr. xlv) and is reported as of service in laryngitis and bronchitis.

Cresol Saponate. — By melting pure soft soap in a dish on a steam-bath and mixing it with an equal quantity of clear, crude carbolic acid, heating the solution until it remains clear upon cooling, a wine-colored liquid is produced. Cresol saponate has a specific gravity of 1.060, is of neutral reaction, and soluble in all proportions in water, alcohol, or glycerin. The liquid is possessed of useful antiseptic properties.

Sodium Paracresotate.—Paracresotic acid is obtained by combining carbonic acid with paracresol in the presence of sodium. It occurs as white, brilliant, acicular crystals; soluble in hot water, ether, alcohol, and chloroform. Sodium paracresotate is a fine crystalline powder; of a bitter, but not unpleasant, taste; moderately soluble in water. In warm-blooded animals the salt retards the respiratory movements and reduces blood-pressure. It possesses antipyretic and antiseptic virtues. It has been given internally in rheumatism, typhoid fever, and the gastro-intestinal catarrh of nursing infants. This substance checks diarrhœa and acts as an intestinal disinfectant. The maximum doses of sodium paracresotate for a child two years of age is 0.50 Gm. (gr. viiss) daily; for a child 4 years of age, 1 Gm. (or gr. xv); and for one 10 years of age 3 Gm. (or gr. xlv). Beneficial results have also been reported from the use of this soda salt in the treatment of catarrhal pneumonia.

Kresin.—This compound contains 25 per cent. of cresol dissolved by means of an equal quantity of sodium cresoxylacetate. Kresin is a brown liquid, with an odor like that of cresol, and forms a clear neutral solution in water. It is said to be less poisonous and less irritant than carbolic acid, 2 c.cm. (or f℥ss) being given internally to a rabbit without deleterious results. It does not render the hands or instruments slippery, nor does it corrode metals. From $^1/_2$- to 1-per-cent. solutions are efficient for disinfectant purposes in surgery. Kresin is likewise very useful in the disinfection of rooms, discharges, water-closets, and waste-pipes. A 5- and 10-per-cent. kresin soap has been prepared and is adapted to use in various forms of skin disease.

Chlorphenol.—This name is given to a liquid obtained by the action of chlorine-gas upon carbolic acid. It is a mixture of chlorphenols, and is a dense, volatile fluid of pleasant odor. Chlorphenol is regarded by Passerini as of value in the treatment of pulmonary tuberculosis, chronic bronchitis, bronchorrhœa and gangrene of the lung, ozæna, and laryngitis. It is administered by inhalation, the daily dose being from 1.20 to 2 c.cm. (or *m*xx-xxx). Chlorphenol has been used as a local application to ulcers, especially those due to tubercular deposit.

[1] *Medical Bulletin*, Nov., 1894, p. 420.

Saprol is a mixture of crude cresols, containing pyridin bases, and used for disinfection purposes.

Parachlorphenol is a solid substance, scarcely soluble in water, but readily soluble in alcohol. It possesses decided antiseptic properties. In the treatment of laryngeal tuberculosis the affected surface is first painted with a weak solution. The strength of the solution may be gradually increased to 50 per cent. After an application there is a slight burning sensation. This, however, soon disappears, and gives place to an anæsthesia which continues for several hours. Parachlorphenol is also an advantageous application to enlarged tonsils. It is useful, moreover, in disinfecting tuberculous sputum. Parachlorphenol is likewise of service in otitis media, suppuration of the maxillary sinus, and hypertrophy of the tonsils. This agent was applied in the form of a solution, at first weak and subsequently more concentrated, until it might be employed in the strength of 50 per cent.

Bromphenol.—This is a fluid of analogous composition to chlorphenol, bromine taking the place of chlorine. Bromphenol is likewise a mixture, is of a purple color, and has less of the carbolic-acid odor than chlorphenol. Both these substances are freely miscible with water, alcohol, and alkaline fluids. Both have given excellent results in the treatment of erysipelas, as reported by Dr. I. Tchourilow, of St. Petersburg. The remedies were used in the form of a 2-per-cent. ointment.

Aseptol.—Sozolic acid, or orthophenolsulphonic acid, is obtained by dissolving carbolic acid in concentrated sulphuric acid. Sozolic acid is an amber-yellow or reddish fluid, readily soluble in water, alcohol, and glycerin, of a caustic taste, and a faint odor of carbolic acid. A solution containing from 30 to 35 per cent. of sozolic acid is commercially known as aseptol.

Diaphtol. — An analogous chemical compound (orthoquinolin-metasulphonic acid) is termed diaphtol, and though not an energetic antiseptic under its own form, is efficient when transformed into a diaphtolate by being dissolved in an alkaline solution. Diaphtolate of sodium is a clear, yellow fluid, very destructive to micro-organisms. Diaphtol is but slightly toxic, does not give rise to gastric or intestinal irritation, and seems well adapted to act as a disinfectant to the digestive and genito-urinary tracts. Diaphtol is eliminated unchanged by the kidneys. Urine in which it is present may be kept for several days without alteration.

Guaialin.—The benzoic acid ester of methylene diguaiacol has received the name of Guaialin from its discoverer, Dr. S. Lewis Summers, of Philadelphia. It is a green powder representing in combination 7 per cent. of formaldehyde, 30 per cent. of benzoin, and over 60 per cent. of guaiacol. It is soluble in alcohol, but not in water. It is soluble in the gastro-intestinal secretions as it enters the blood and is discharged by the urine. It is claimed to be superior as an antiseptic, to salicylic acid, or the carbonates of creosote or of guaiacol. It is not only bactericidal in the digestive tract, but as it enters the blood it is claimed to act as a general disinfectant, especially to the lungs and kidneys. It reduces fever temperature. As a stimulant to the mucous membrane, it is recommended in the treatment of gastro-intestinal catarrh. It is also useful in chronic bronchitis and in phthisis, reducing the secretions, the fever, and the cough, and increasing the appetite. It is said to have no depressing effect upon the heart. Usual dose is 0.30 to 0.65 Gm. (gr. v to x) several times a day, in capsules (6 to 8 Gm., or 90 to 120 grains in a day).

Steresol.—This name has been given by Dr. Berlioz, of Grenoble, to an antiseptic varnish of which the formula is as follows:—

℞ Pulv. acaciæ	264	Gm. or ʒviiiss.
Benzoin.,		
Balsam. Tolutan. aa	10	Gm. or 3iiss.
Acid. carbolic. cryst.	101	Gm. or ʒiii 1/4.
Ess. cinnamom.	6	c.cm. or f3iss.
Saccharin.	6	Gm. or 3iss.
Alcohol. q. s. ad	946	c.cm. or Oij.—M.

Steresol adheres like a varnish to the skin and mucous membrane, and has been used with advantage in diphtheria and tuberculous ulcers of the skin and tongue. The application produces no pain, the layer remains in position for several hours, and it is stated that the carbolic acid does not entirely evaporate from the compound until after an exposure of twenty-four hours.

Tolysal.—The name tolysal has been given to a substance, which in chemical composition is the salicylate of tolypyrin, the latter being a lately-introduced synthetical compound analogous to antipyrin. Tolysal occurs in the form of small, almost colorless crystals, of somewhat bitter taste, slightly soluble in water, soluble with difficulty in ether, easily soluble in alcohol and acetic ether. In doses of 1 Gm. (or gr. xv) every two hours tolysal has no cumulative effect; it has a favorable influence upon sleep, and gives rise to no unpleasant after-effects.

Tolysal is of marked efficacy in acute articular rheumatism, as well as in chronic forms of the disease, and in muscular rheumatism. It has produced improvement in rebellious cases which had remained uninfluenced by salicylic acid as ordinarily administered. Tolysal has also an analgesic effect and proved useful in the treatment of rheumatic neuralgia. In articular rheumatism it has been administered in daily doses of 3 to 6 Gm. (or gr. xlv-xc). As an anodyne the dose is 1 to 3 Gm. (or gr. xv-xlv) and in rheumatic neuralgia from 1 to 2 Gm. (or gr. xv-xxx) during the same period. Tolysal exerts a decided antipyretic action in both continued and remittent fevers. It is also useful in influenza.

Antispasmin.—A substance upon which this name has been bestowed consists of one molecule of narceine sodium and three molecules of sodium salicylate. Antispasmin is a white powder, slightly hygroscopic, readily soluble in water, of an alkaline reaction, and contains about 50 per cent. of pure narceine. This compound was found serviceable by the late Professor Demme in relieving various spasmodic affections, and was recommended as well adapted for use among children. It was employed with advantage in pertussis and other forms of nervous cough. The dose is from 0.006 to 0.10 Gm. (or gr. $^1/_{10}$-iss).

Salaktol.—This name has been unwisely chosen, since it bears too close a resemblance to that previously given to a different compound, salacetol. Salaktol is a combination of sodium salicylate, sodium lactate, and hydrogen dioxide. It is reported to be an excellent application in diphtheria, being painted upon the throat every two or three hours, and given internally in tablespoonful doses at the same intervals. Salaktol is also utilized as a gargle and by inhalation.

Borsalyl.—A compound obtained by the action of 25 parts of boric acid on 32 parts of sodium salicylate in the presence of a small quantity of distilled water is a useful antiseptic for external application.

Salicylamid.—This is a yellow crystalline substance, without odor or taste, and soluble in hot water. It is said to be efficient in smaller doses and to possess more analgesic power than salicylic acid.

Commercial salicylic acid may be contaminated by the presence of para- and ortho- cresotic acids, which have remained in the process of manufacture. Both these substances are toxic. Professor Charteris, of Glasgow, found paralysis and death to be caused in rabbits by doses of 0.20 Gm. (or gr. iij) of the former per pound of the body-weight. Orthocresotic acid produced the same symptoms and was fatal to the rabbit in the dose of 0.065 Gm. (or gr. j) per pound weight. The cresotate of sodium has been employed therapeutically as an antipyretic in doses of 6 to 8 Gm. (or 3iss-ij). Demme used it in acute rheumatism, catarrhal pneumonia, and typhoid fever among children, and in the gastro-intestinal catarrh of nursing women.

CRETA PREPARATA (U. S. P., B. P.).—**Prepared Chalk.** (For chalk preparations, see **Calcium.**)

CROCUS (B. P.).—**Saffron.**
Dose, 0.65 to 1.30 Gm. (or gr. x-xx).

Preparation.

Tinctura Croci (B. P.).—Tincture of Saffron (5 per cent.). Dose, 0.30 to 1 c.cm. (or *m*xv).

Pharmacology.—The stigmas of Crocus sativus (Irideæ) are official under the title of Crocus. "The dried stigmas and tops of the styles of Crocus sativus" (B. P.). They are obtained from cultivated plants in the south of Europe. Spanish saffron has a strong, peculiar odor; an aromatic, bitter taste; and imparts a yellow hue to the saliva when chewed. So-called American saffron is a different plant, the Carthamus tinctorius, or safflower, of which the flowers are used. Saffron of good quality, however, is cultivated in Pennsylvania. A 10-per-cent. tincture was formerly official.

Therapy.—Saffron is slightly aromatic and feebly anodyne and antispasmodic. A hot infusion called saffron-tea is made from the safflower, and not from saffron; it is used in domestic practice to bring out the eruption in measles and scarlet fever and as a diaphoretic. In Europe, the tincture of saffron is employed as an emmenagogue and given in flatulent dyspepsia and colic. Externally it has been used in bruises, rheumatic and neuralgic pains, and in the form of ointment to hæmorrhoids. In this country its only use, as a rule, is that of a coloring agent in pharmacy.

CUBEBA (U. S. P.).—**Cubeb.**
CUBEBÆ FRUCTUS (B. P.).—**Cubebs.**
Dose, 2 to 4 Gm. (or 3ss-j) of the recently-powdered drug.

Preparations.

Fluidextractum Cubebæ (U. S. P.).—Fluid Extract of Cubeb. Dose, 0.60 to 2 c.cm. (or *m*x-xxx).

Oleoresina Cubebæ (U. S. P.).—Oleoresin of Cubeb. Dose, 0.30 to 2 c.cm. (or *m*v-xxx).

Trochisci Cubebæ (U. S. P.).—Troches of Cubeb (0.03 c.cm., or *m*ss, oleoresin).

Oleum Cubebæ (U. S. P., B. P.).—Oil of Cubeb. Dose, 0.30 to 1.20 c.cm. (or *m*v-xx).

Tinctura Cubebæ (B. P.).—Tincture of Cubeb (20 per cent.). Dose, 2 to 4 c.cm. (or f3ss-j).

Pharmacology.—The dried, unripe, but fully-grown fruit of Piper Cubeba (Piperaceæ). This plant, cultivated in Java, contains a volatile oil (15 per cent.), and an acrid resin, **Cubebic Acid,** with fat, gum, etc. **Cubebene,** a camphoraceous substance, can be separated from the volatile oil, leaving **Cubeben,** a liquid oil, behind. The deposit from the oleoresin consists principally of **Cubebin,** which is inert, medically. The medicinal activity of the drug consists principally in the volatile oil and cubebic acid, which are both present in the oleoresin.

Physiological Action.—The effects of cubeb are those of an aromatic stimulant to the stomach, improving the digestion in small doses and increasing appetite, deranging digestion in larger doses and acting as an irritant. Cubeb increases the force and frequency of the heart's action, stimulates the genital organs, and promotes menstruation. It is eliminated by the skin (frequently causing an urticarial or vesicular eruption). Cubeb may likewise produce, especially in young subjects, a bright-red rash, which disappears in the course of a few days after discontinuance of the drug and which may be followed by fine desquamation. It is also removed from the system by the bronchial mucous membrane (acting as an expectorant and antiseptic), but chiefly by the kidneys (increasing the quantity of urine and disinfecting the urinary passages). The addition of nitric acid to the urine of a person taking cubeb produces a precipitate which bears a resemblance to that of albumin.

Therapy.—The powder of cubeb is considered a good application in hay fever, chronic nasal catarrh, and follicular pharyngitis. In hay fever, if it does not increase the irritation, it may be useful. In asthma, or sensitive hypertrophies in the nose, cubeb cigarettes are smoked with relief. Cubeb is also sometimes given internally in cases of chronic bronchitis accompanied by free secretion.

Cubeb is principally used in blennorrhœa, cystitis, and purulent affections of the genito-urinary tract. In gonorrhœa it may be given in all stages of the disease, acting best in the acute stage. Some patients, however, appear to be very susceptible to the effect of this drug, small doses causing digestive disturbance, irritability of the bladder, and bloody urine. A mixture of cubeb and alum is an efficacious, though nauseous, remedy in chronic gonorrhœa. It may be thus prescribed:—

℞ Pulv. aluminis ..... 4| Gm. or 3j.
Tinct. cubebæ ..... 120| c.cm. or f℥iv.
M. Sig.: A teaspoonful every four hours.

By a combination of cubeb and copaiba the effect of each agent in gonorrhœa is increased:—

℞ Oleoresinæ cubebæ,
Copaibæ ..... aa 4| c.cm. or f3j.
Pulv. sacch. alb.,
Pulv. acaciæ ..... aa 15|5 Gm. or ℥ss.
Aquæ menthæ piperitæ .....q. s. ad 120| c.cm. or f℥iv.
M. Sig.: Teaspoonful three times a day.

(Also see formulæ under **Copaiba.**)

Functional irritability of the bladder, so common in women, is often relieved by cubeb. Cubeb is sometimes of service, also, in nocturnal incontinence of urine. In chronic catarrh of the lower bowel and in the interparoxysmal periods of pseudomembranous enteritis cubeb is likewise advantageous. By some writers it is esteemed of value in the treatment of hæmorrhoids.

Atonic dyspepsia may receive benefit from the temporary employment of small doses of cubeb, which are of service also in bronchorrhœa.

The troches of cubeb may be used in the treatment of sore throat and hoarseness, from two to five daily being allowed to slowly dissolve in the mouth.

CUPRUM.—Copper.

Preparations.

Cupri Sulphas (U. S. P., B. P.).—Copper Sulphate. Dose, as an astringent, 0.01 to 0.13 Gm. (or gr. $^1/_6$-ij); as an emetic, 0.32 to 0.65 Gm. (or gr. v-x).

Cupri Acetas.—Copper Acetate. Dose, 0.006 Gm. (or gr. $^1/_{10}$).

Cuprum Ammoniatum.—Ammoniated Copper. Dose, 0.01 to 0.065 Gm. (or gr. $^1/_6$-j).

Cupri Arsenis.—Copper Arsenite. Dose, 0.0016 to 0.065 Gm. (or gr. $^1/_{40}$-j).

Cuprum Aluminatum.—Aluminated Copper. Lapis Divinus. External use.

Ceratum Cupri Acetatis.—Cerate of Copper Acetate. (Melt together yellow wax, 50 parts; Burgundy pitch, 25 parts; European turpentine, 15 parts; strain, incorporate thoroughly finely-powdered acetate of copper, 5 parts; pour into molds, to form cakes of about 1 centimetre thickness). Green cerate, for corns, warts, etc.

Pharmacology.—Copper has but one official salt—the sulphate—which is an irritating poison, although the metal is inert, because insoluble. Copper was formerly used very much in making cooking utensils for family use, but it was found that, unless kept very bright and clean, they would give rise to poisoning by the formation of verdigris, a basic copper acetate. Copper is sometimes added to pickles to make them of a brighter green color, a fraud which can be detected by placing a blade of a knife, or polished piece of steel, in the liquor; if it contain copper, there will be a deposit of metallic copper upon the iron in the course of a few minutes. It is held that the very small amount of copper that would be introduced into the system by eating such a pickle would be only a mere fraction of a grain, and not enough to cause symptoms. A far more dangerous source of poisoning is found in the wall-paper pigments containing copper arsenite, which is very poisonous. It is not only the green colors that are dangerous, but all vivid colors, such as scarlet, crimson, or lake. It is especially velvet or embossed papers that are likely to be loaded with pigment, and these should never be used for a dwelling-house unless first tested and found to be free from copper or arsenic by the ordinary tests for those poisons.

Physiological Action. — When locally applied, copper sulphate is an astringent or a caustic, according to the manner of application. Injected hypodermically, it causes coma and convulsions (in cats) and death from respiratory failure; in overdose by the stomach it causes fatal gastro-enteritis. Copper in very small proportion exists normally in the blood, and in minute doses it exerts a tonic effect upon the organism. This is well shown in some skin diseases of a dry type, due to defective nutrition, and in incipient or threatened phthisis. The secretions along the gastro-intestinal tract are increased, as shown by the salivation, vomiting, and purging. It is a local, and

not a systemic, emetic. Copper is eliminated by the liver, kidneys, salivary and intestinal glands. It may remain, like other metals, stored up for a considerable period within the liver.

When any of the salts of copper have been swallowed in overdose there are nausea, vomiting and retching, purging of blood and mucus, and rapid depression of bodily powers; and the latter may be the more prominent. In chronic poisoning, pharyngeal irritation, bronchial catarrh, colic, diarrhœa, or dysentery, salivation, anæmia, and emaciation occur. There is sometimes a green line upon the gums. Jaundice and fatty degeneration or atrophy of the liver ensue, and pulmonary congestion or consolidation may set in. The effects upon the nervous system are seen in headache, defective co-ordination, and weakness, with nervous vomiting. Toxic symptoms manifest themselves very soon after the metallic salt has been taken. The chemical antidote is potassium ferrocyanide followed by demulcents, eggs, milk, oil, etc., and the stomach should be irrigated with an alkaline solution, counter-irritation applied, and anodynes given. The incompatibles of copper are metallic sulphides, alkalies and alkaline earths, iodides, and vegetable infusions containing tannin.

Therapy.—Copper sulphate, in solid stick, is used as a superficial caustic in indolent ulcers, exuberant granulations, and in syphilitic and other sores in the mouth and throat. It may also be lightly applied in cases of granular lids, or a solution ($^1/_4$ to $^1/_2$ of 1 per cent.) instilled into the eye in subacute conjunctivitis; but for this the acetate is preferred. A crystal of copper sulphate is likewise serviceable as an hæmostatic in checking hæmorrhages from slight wounds, leech-bites, or the surface of irritable ulcers. A solution of this salt is employed locally with benefit in order to suppress excessive and chronic discharges. In the strength of from 0.65 to 1.30 Gm. (or gr. x-xx) to 30 c.cm. (or f℥j) of menstruum it may be thrown into the bowel for the relief of chronic diarrhœa or dysentery. The same method is beneficial in acute diarrhœa of severe form. From 0.32 to 0.65 Gm. (or gr. v-x) of the sulphate dissolved in 30 c.cm. (or f℥j) of glycerin is one of the preparations which may be recommended for use in pseudomembranous enteritis. The fluid should be injected into the bowel during the interparoxysmal period for the purpose of modifying the condition of the mucous membrane. A weak, aqueous solution of copper sulphate is an excellent stimulant dressing to chancres and chancroids, and forms a good injection in leucorrhœa, vaginitis, and gleet.

Copper sulphate, made into the form of a pencil, has been employed in the treatment of endometritis, introduced within the cervical canal and held in place by a tampon of iodoform gauze. Although praised by some writers, Boursier asserts that it may give rise to violent uterine colic, metrorrhagia, a profuse discharge, and vomiting. The application is likewise capable of causing a loss of substance of the mucous membrane, and may be followed by atresia. Pencils or suppositories containing copper sulphate should not be left too long in position. Dr. Tarnier esteems a 5-per-cent. solution of copper sulphate a valuable disinfectant for washing out the uterus and vagina after delivery.

This salt enters into the composition of injections for gonorrhœa, and may be advantageously combined as follows:—

℞ Cupri sulphatis		75	Gm. or gr. xij.
Zinci sulphatis,			
Plumbi acetatis	aa 1	55	Gm. or gr. xxiv.
Fluidext. krameriæ	4		c.cm. or f℥j.
Vini opii	7	5	c.cm. or f℥ij.
Aquæ rosæ	q. s. ad 180		c.cm. or f℥vj.—M.

℞ Cupri sulphatis		32	Gm. or gr. v.
Fluidext. geranii	15		c.cm. or f℥ss.
Glycerini	30		c.cm. or f℥j.
Aquæ rosæ	75		c.cm. or f℥iiss.—M.

The oleate of copper is an admirable astringent, antiseptic, and antiparasitic preparation, especially valuable in the various forms of tinea trichophytosis.

The sulphate is sometimes effective as a local stimulant in an indolent impetigo, and a weak solution is efficacious in ulcerative stomatitis and thrush. Thirty-one Gm. (or ℥j) of the sulphate in a half-litre (or f℥xvij) of water is a solution which has been found very efficacious in the treatment of scabies. Other cutaneous affections—as psoriasis, chronic eczema, sycosis, favus, acne, hyperidrosis, and bromidrosis—are ameliorated by the topical application of copper sulphate or acetate in the form of an ointment or a lotion, or the oleate made into a 10- or 20-per-cent. ointment. A gargle containing 5 grains of copper sulphate to the ounce of water does good in relaxed sore throat. The sulphate, or other salts of copper, may be employed externally in the following formulæ:—

℞ Cupri sulphatis		32	Gm. or gr. v.
Aquæ hamamelidis dest.	150		c.cm. or f℥v.

M. For a gargle, or apply over the surface for hyperidrosis or bromidrosis.

℞ Cupri sulphatis		65 to 2	Gm. or gr. x vel xxx.
Acidi borici	4		Gm. or ℥j.
Creosoti		60	c.cm. or *m*x.
Ungt. aquæ rosæ	31		Gm. or ℥j.

M. Useful in sycosis and parasitic diseases of the skin.

In summer diarrhœa and cholera infantum copper sulphate is of undoubted efficacy. It is likewise a valuable remedy in the diarrhœa and dysentery of adults. Diarrhœa, whether acute or chronic, will often yield to copper sulphate. It has been found of service in restraining tuberculous diarrhœa, and has been highly praised by some writers for its virtue in the diarrhœa of typhoid fever. Copper sulphate has also been administered with good results in cholera. Tænia may be dislodged and passed under the use of small doses of copper sulphate. Phillips begins with about 0.01 Gm. (or gr. $^1/_6$) and gives it every morning upon an empty stomach, gradually increasing the dose until 0.20 to 0.32 Gm. (or gr. iii-v) can be taken without vomiting. In actinomycosis, A. D. Bevan recommends copper sulphate, 0.015 to 0.06 Gm. (or gr. $^1/_4$-j) three times a day, and locally irrigation with a 1-per-cent. solution.[1]

The same salt is useful in bronchorrhœa. A small dose of the sulphate, 0.003 Gm. (or gr. $^1/_{20}$) three times a day, will sometimes allay the vomiting of pregnancy. Small doses of the same salt, given with or after meals, improve nutrition, and have been recommended as of service in ecthyma, scrofula, and tuberculosis.

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[1] *Jour. Amer. Med. Assoc.*, Nov. 11, 1905.

Luton makes use in tuberculosis of a "cupric serum," made by dissolving 0.20 Gm. (or gr. iij) of copper acetate in 90 c.cm. (or f℥iij) of his "artificial serum." Of this fluid 5 c.cm. (or f℥i $^1/_4$) is an average dose for an adult.

Dr. A. F. Price, U. S. N., recommends the sulphate as a remedy in syphilis. He states that it is of particular efficacy in syphilitic adenopathies, and, although slow in removing syphilides of the secondary stage, it prevents the development of mucous patches and throat symptoms. He gives it in an average dose of 0.002 Gm. (or gr. $^1/_{30}$) thrice daily and recommends that its use should be omitted one day in each week.

Its action as a prompt emetic is best utilized in phosphorus poisoning, where it is also antidotal. Copper has a very decided action upon the nervous system, and the ammoniated copper particularly is used and highly praised for its effects in chronic neuroses, epilepsy, chorea, hysteria, and in the treatment of facial neuralgia. It is claimed that the administration of 0.005 Gm. (or gr. $^1/_{12}$) of copper sulphate every night at bed-time will relieve the cramping pain in the legs from which pregnant women sometimes suffer.

In chorea, especially when connected with the presence of tænia or other worms and in epileptiform convulsions dependent upon intestinal worms, Phillips has witnessed good results from the administration of the sulphate. In asthma, also, he has observed benefit from its use.

Dr. Boardman Reed speaks favorably of the use of copper arsenite in minute doses as an antispasmodic in cases of after-pains.[1] He gives 0.000065 Gm. (or gr. $^1/_{1000}$) every half-hour with complete relief. It has also been highly extolled in the treatment of diarrhœa of infancy, where it may exert an antiseptic action upon the contents of the intestinal tract, when given in small and frequently-repeated doses, as first suggested by Dr. Reed. A solution prepared in this manner is often of marked benefit in after-pains, diarrhœa, and in cholera morbus:—

℞ Cupri arsenitis ..... |03 Gm. or gr. ss.
Aquæ camphoræ,
Aquæ cinnamomi .....aa 120| c.cm. or f℥iv.
M. Sig.: From one-half to one teaspoonful every half-hour or hour until relieved.

Copper arsenite, in doses of 0.0013 to 0.002 Gm. (or gr. $^1/_{50}$-$^1/_{25}$) after each meal, is said to be of value in the treatment of functional anæmia. In four cases of epidemic cerebro-spinal meningitis, Kolipinski gave arsenite of copper for the first and second days, every half-hour when the patient was awake; as the symptoms improved the intervals were prolonged to every three or four hours; on the fourth day the remedy was discontinued, when convalescence appeared. With children he used 0.000025 to 0.00005 Gm. (or gr. $^1/_{2400}$-$^1/_{1200}$) at a dose, with an adult 0.0002 Gm. (or gr. $^1/_{320}$). In pronounced chlorosis Liégeois has obtained good results from copper, administered in the following form:—

℞ Cupri acetat. neutralis ..... |01 Gm. or gr. $^1/_6$.
Sodii phosphat. crystall. ..... |045 Gm. or gr. $^3/_4$.
Pulv. glycyrrh.,
Glycerini ..... aa q. s.
M. et ft. pil. no. j. Mitt. tales no. xxx.

One or two pills were given twice daily before meals. The drug could be taken for three months uninterruptedly without occasioning any derange-

[1] *Times and Register*, Dec. 6, 1890.

ment of the digestive functions. If the chlorosis was accompanied by amenorrhœa, menorrhagia, or leucorrhœa, 0.045 to 0.10 Gm. (or gr. $^{3}/_{4}$-iss) of newly-prepared powdered ergot was added to each pill.

The internal use of copper sulphate is recommended by some authorities in laryngeal croup, or diphtheria, small doses being given every quarter- or half- hour until vomiting is produced, when the dose is reduced and administered at longer intervals.

Aluminated copper is used externally as a stimulant and astringent to ulcers, and as a collyrium for inflammation of the conjunctiva. It is a powder compound of equal parts (30 parts) of copper sulphate, alum, and potassium nitrate, with a small proportion (2 parts) of camphor.

Dr. St. Germain recommends the hypodermic injection of extemporaneously prepared phosphate of copper as of benefit in case of glandular enlargements among children. Some local and general reaction is produced, but this effect soon subsides and is followed by amendment. The salt is obtained by mixing solutions of sodium phosphate and copper acetate, and the injection is generally made behind the great trochanter once in two weeks. Dr. F. Schmidt asserts that copper oxide possesses tæniacidal properties. He gives it in gradually increasing doses for two weeks, when a dose of castor-oil is administered. Laboratory experiments have shown that copper, either as the sulphate, or in colloid or metallic state, exerts a powerful germicidal action. It has been suggested as a means of purifying drinking-water which has become contaminated with typhoid or other pathogenic bacteria. The bacilla are destroyed by quantities of copper which would not be toxic to the human organism.

CURARE.—Curare, Woorara, or **Arrow-poison,** is a blackish-brown brittle substance, of unknown composition, used by natives of South America as an arrow-poison, and probably contains Paulinia curare and other plants of the Strychnos family, or Cocculus. An extremely poisonous alkaloid, **Curarine,** has been obtained from curare.

Physiological Action.—No effect follows the introduction of this drug into the stomach, as absorption is slow, and it is very rapidly thrown out of the circulation by the kidneys, and hence it is unlikely that it is a poison allied to strychnine or cocculus; it acts more like a virus of animal origin.

It must be injected hypodermically in order to produce its characteristic symptoms, which are: paralysis of the voluntary muscles by loss of power of the end-organs of the motor nerves; subsequently, the brain-centres are affected, and, unless life be sustained by artificial respiration, death occurs by respiratory failure. Curarine is without effect upon the sensory nerves. The blood-pressure is lowered and the heart is weakened. Sugar appears in the urine. The antidotes are strychnine and atropine, diffusible stimulants, artificial respiration, warmth and friction to the extremities, the use of the catheter, etc. Professor Reichert has investigated the influence of curare upon heat-production and heat-dissipation. A variable effect was observed, heat-dissipation being always increased, while production was either increased or diminished.

Therapy.—The use of curare in practical medicine at present is limited to the treatment of hydrophobia, two cases having been reported in which the symptoms disappeared under its use and the patient recovered. The drug is very variable in composition and effects, but 0.003 Gm. (or gr. $^{1}/_{20}$) may be given hypodermically and repeated according to the symptoms.

CURCAS.—Purging Nut. The seeds of Curcas purgans (Euphorbiaceæ), a shrub which grows in the West Indies, South America, and other tropical countries, contain a colorless or light-yellow fixed oil, devoid of odor and of a pleasant, almond-like taste. The oil is a local irritant, and has been used diluted as a topical application in rheumatism. Taken internally it is an active purgative in the dose of 0.60 or 0.75 c.cm. (or *m*x-xij), and has been used to relieve constipation, lessen dropsical effusions, and to expel worms.

Poisoning has sometimes occurred in persons who had eaten curcas-seeds, the symptoms being vomiting, catharsis, and prostration.

CUSPARIÆ CORTEX (B. P.).—**Cusparia-bark, Angostura-bark.**

Preparations.

Infusum Cuspariæ (B. P.).—Infusion of Cusparia (5 per cent.). Dose, 30 to 60 c.cm. (or f℥i-ij).

Liquor Cuspariæ Concentratus (B. P.).—Concentrated Solution of Cusparia. Dose, 2 to 4 c.cm. (or f℥ss-j).

Pharmacology.—The dried bark of Cusparia febrifuga is official in the British Pharmacopœia under this title. It belongs to the **Rutaceæ**, and is a small tree growing along the Orinoco. It is also called Angostura bark (under which name it was official in a former edition of the U. S. P.), from its place of shipment in South America. The bark comes in bundles of quills, having a bitter, somewhat aromatic, taste, and a peculiar odor. It contains, besides various vegetable principles, a volatile oil and resin, with an alkaloid, **angosturine.** Occasionally, a mixture of false Angostura bark has been detected, which is poisonous, as it belongs to Strychnos nux-vomica, and contains **brucine.** As Cusparia-bark is found everywhere in the West Indian shops, where it is known to Spanish Americans as **Carony** (the tree itself is termed *Orayuri*), it is available on any emergency. So valuable is it, in low fevers of all kinds, that it has become a favorite in many parts of Europe and Great Britain, as well as in India; and, though it is not the least astringent, it is a popular remedy for dysentery in all climates. Its disrepute in the United States is due to the fact that, as imported, it is adulterated with false angostura. The physical characteristics of the two barks may be compared sufficiently to permit of ready identification:—

True Angostura.	*False Angostura.*
Flat or curved pieces or quills, 1 to 3 inches long, 1 to $^1/_2$ inch wide, and $^1/_{16}$ to $^1/_8$ inch thick; obliquely cut on inner edge. Externally a yellowish gray, mottled, corky layer, which can be scraped off and shows a dark-brown, resinous layer. Inner surface, light brown, flaky. Fracture, short, smooth, resinous, and under lens showing numerous white glistening striæ of crystals of calcium oxalate. Odor musty and disagreeable. Taste, bitter and aromatic, and when leaves are chewed for some time a sense of heat and pungency in the throat and on the fauces.	Much the same shape, but more gray in color externally; the cork patches of a rust color; warty. Inside, brown. Fracture smooth, but shows no white striæ of calcium oxalate. Odor rather sweetish than otherwise. Taste, intensely bitter. The inner surface gives bright-red color with nitric acid, owing to presence of brucine, which true angostura does not.

Pereira states that cusparia is valuable not only in intermittents and remittents, but also in the bilious forms of the latter, such as occur in the tropics. Williams and Wilkinson, and Hancock, corroborate this opinion; while Winterbottom is even more emphatic, and extols the drug in adynamic continued fever.

A convenient tincture may be made in the usual way, by macerating the dried bark in coarse powder in five times its weight of alcohol. It should be put in a well-stoppered bottle; allowed to stand eight days in a cool place, shaking twice daily; then poured off, strained, and filtered. The infusion is incompatible with metallic sulphates, antimony, lead and mercurial salts, silver nitrate, and infusions containing tannin.

Physiological Action and Therapy.—In small doses cusparia is a bitter tonic, and in large doses of the recent infusion it causes vomiting or purging. In South America it has been largely employed by the natives in the treatment of diarrhœa and dysentery. As a stimulating tonic, it may be given for loss of appetite and weak digestion. The dose of the powder is from 0.32 to 2 Gm. (or gr. v-xxx). Nausea is prevented by combining it with aromatics.

CUSSO (U. S. P., B. P.).—**Kousso, Brayera, Red Cusso.**
Dose, 15.5 Gm. (or ℥ss).

Preparation.

Fluidextractum Cusso.—Fluid Extract of Kousso. Dose, 15 to 30 c.cm. (or f℥ss-j).

Pharmacology.—"The dried flowers of the female inflorescence of Hagenia Abyssinica (Rosaceæ)," or "the dried panicles of pistillate flowers of Brayera anthelmintica" (B. P.), a tree of Abyssinia. Bedall, of Munich, found **Kosin** a crystalline resinous substance of acid reaction, combined with tannic acid, a volatile oil, and a resinous substance (**Koussein**), which is an impure kosin. In large doses brayera is a gastro-intestinal irritant, and is liable to cause vomiting, but no toxic effects have been observed. It is usually administered in infusion, 15.5 Gm. (or ℥ss) of the flowers in a pint of hot water, the whole to be swallowed at once, for the expulsion of tape-worm. It should be followed by a purgative in about two hours, castor-oil being ordinarily used. **Kosin** is said to be less liable to cause nausea than the fluid preparations. Brayera should not be given during pregnancy, for fear of causing abortion. **Koussein** is an amorphous, yellowish-brown powder, has a bitter taste, is soluble in alcohol, ether, and chloroform, and but slightly soluble in water. It has been given as an anthelmintic in doses from 1 to 4 Gm. (or gr. xv-lx). According to a more recent authority, Leichsenring, the active principle of the drug is an amorphous substance which he called **Kossotoxine.** It is insoluble in water, but dissolves in alcohol, ether, benzol, or carbon disulphide.

Therapy.—In the treatment of tape-worm, it is given as a fluid extract of the fresh flowers, in doses of 16 c.cm. (or f℥iv) to an adult; below 12 years of age the dose should be one-half of this quantity, or less. If it does not cause evacuation of the bowel in four hours, a cathartic should be given.

CYDONIUM. — **Cydonium, Quince-seeds** are the seeds of Cydonium vulgaris (Rosaceæ). These seeds, containing about 20 per cent. of vegetable

mucilage, were formerly official in order to provide the **Mucilage of Cydonium,** which is best made with rose-water. It is used locally in inflammation of the skin, or conjunctivitis, or it may be used internally, *ad libitum,* in disorders of the alimentary canal requiring a demulcent.

CYNOGLOSSUM.—The root of the Cynoglossum officinale (Boragineæ), an indigenous plant, is of interest, because it contains **Cynoglossine,** a brown, amorphous substance, soluble in water and alcohol, having an alkaline reaction, which Buchheim, its discoverer, found to possess narcotic powers. Its physiological action is said to be analogous to that of curare.

CYPRIPEDIUM (U. S. P.).—**Cypripedium, Ladies'-slipper.**
Dose, 1 to 2 Gm. (or gr. xv-xxx).

Preparation.

Fluidextractum Cypripedii (U. S. P.).—Fluid Extract of Cypripedium. Dose, 0.60 to 1.20 c.cm. (or *m*x-xx).

Pharmacology.—"The dried rhizome and roots of Cypripedium hirsutum, or of Cypripedium parviflorum (Orchidaceæ)." The roots have a heavy, disagreeable odor, and contain a volatile oil, a volatile acid, resins, and a peculiar tannin. **Cypripedin** is an impure oleoresin (dose, 0.13 to 0.20 Gm., or gr. ii-iij).

Physiological Action and Therapy.—In its effects it resembles valerian as an antispasmodic, tonic, stimulant, and diaphoretic. It is given in neurasthenia, nervous hyperæsthesia, neuralgia, nervous headache, hypochondria, insomnia, and epilepsy.

DAMIANA.—**Damiana** is a small, mint-like plant (Turnera diffusa, microphylla, or aphrodisiaca; natural order, Turneraceæ), bearing yellowish-white fragrant flowers, which grow in southwestern Texas, Mexico, and South America. Other plants have been sold under the name of damiana, and it is probable that some of the uncertainty of result has been due to the substitution of some other drug for the Turnera. The leaves are the part used; they contain a volatile oil, a resin, and other constituents. The following preparations have been employed: Extractum damianæ (extract of damiana); dose, 0.32 to 1 Gm. (or gr. v-xv). Extractum damianæ fluidum (fluid extract of damiana); dose, 2 c.cm. (or f℥ss). Glycerol damianæ, phosphori, et nucis vomicæ (containing in each fluid ounce, damiana, 4 Gm., or ℥j; phosphorus, 0.0025 Gm., or gr. $^1/_{25}$; nux vomica, 0.25 Gm., or gr. iv); dose, 4 c.cm. (or f℥j). Elixir Turnera (N. F.), (15 per cent. of damiana); dose, 7.50 to 30 c.cm. (or f℥ii-f℥j).

Physiological Action.—Upon the sexual appetite and function damiana undoubtedly exerts some stimulant effects; but it is also a general tonic. Damiana is thought to have a reconstituent effect upon the spinal and medullary centres. Upon the digestive organs it acts as a carminative, and in larger doses as a cathartic laxative. It is slightly cholagogic, and is also a stimulating diuretic.

A case of poisoning from damiana has been reported, the symptoms being closely analogous to those produced by strychnine. Recovery by treatment usual in intoxication from strychnine occurred.

Therapy.—In nervous dyspepsia, neuralgia, cerebral exhaustion, neurasthenia, or want of tone in the nervous system, also in sick headache or migraine, damiana has been found to be useful. It has been of service in cases of paraplegia and hemiplegia and atony persisting after prolonged illness. It is especially employed, however, in treating functional impotence from any cause, combined with hygienic and other treatment, especially nux vomica, iron, and phosphorus.

Damiana relieves irritability of the bladder and urethra, so often associated with prostatorrhœa or spermatorrhœa. Softness and tenderness of the testes as a result of sexual excess have been benefited by the administration of this drug. In cases of abnormal sexual appetite it has manifested a sedative influence.

DIGITALIS (U. S. P.).—**Digitalis, Fox-glove.**

DIGITALIS FOLIA (B. P.).—**Digitalis-leaves.**
Dose, 0.03 to 0.13 Gm. (or gr. ss-ij).

Preparations.

Extractum Digitalis (U. S. P.).—Extract of Digitalis. Dose, 0.015 to 0.03 Gm. (or gr. $^1/_4$-$^1/_2$).

Fluidextractum Digitalis (U. S. P.).—Fluid Extract of Digitalis. Dose, 0.03 to 0.12 c.cm. (or *m*ss-ij).

Infusum Digitalis (U. S. P., B. P.).—Infusion of Digitalis (1 $^1/_2$ per cent., U. S. P.; or 0.68 per cent., B. P.). Dose, 4 to 15 c.cm. (or f3i-iv).

Tinctura Digitalis (U. S. P., B. P.).—Tincture of Digitalis (10 per cent., U. S. P.; or 12 $^1/_2$ per cent., B. P.). Dose, 0.30 to 2 c.cm. (or *m*v-xxx).

Pharmacology.—"The dried leaves of Digitalis purpurea (Scrophulariaceæ), collected from plants of the second year's growth at the commencement of flowering" (U. S. P.). "The dried leaves of Digitalis purpurea, Linné. Collected from plants commencing to flower" (B. P.). It is now recognized that **Digitalin,** which was formerly official, and considered as the active principle, is a mixture of several bodies, the most active of which is crystallizable **Digitoxin** ($C_{34}H_{54}O_{11}$), according to Kiliani, which, with **Digitalinum verum** and **Digitalein,** represents the cardiac, stimulating action of the drug, while **Digitonin** appears to exert a contrary effect, acting like saponin (Schmiedeberg). M. Cloetta [1] finds that the leaves, as well as the seed, contain digitonin, digitalin, digitoxin, and coloring matter common to both. The seed contains much more digitalin than digitoxin, while in the leaves the reverse is the case. A fifth substance, **Digitin,** seems entirely devoid of physiological and therapeutical actions. These are all non-nitrogenous, and are glucosides. No alkaloid is present in digitalis. It also contains tannin, volatile oil, fatty matter, red coloring matter, chlorophyl, albumin, starch, sugar, gum, lignin, and salts. Two acids have been discovered by M. Morine,—digitalic and antirrhinic. The varying solubility of the active principles in the vehicles used explains the difference of therapeutical effect. Digitalin is insoluble in water, but soluble in alcohol; digitoxin is insoluble in water, sparingly soluble in alcohol; digitalein is soluble in ether; digitonin, soluble in water, sparingly in alcohol. According to Orfila, Nativelle's digitalin is principally digi-

[1] *Arch. exp. Pathol. u. Pharm.*, 1898, 41, 421.

toxin with a little digitalin; it is a very active preparation. Balfour pronounces it, after twenty years' experience, a thoroughly reliable and active drug. One granule ($^1/_4$ mg., or gr. $^1/_{250}$), every night at bed-time is a sufficient dose to produce a decided tonic effect on the heart. The **Digitalinum Germanicum** (Merck) appears to be a reliable and active preparation. Dose, 0.003 to 0.015 Gm. (or gr. $^1/_2$ to $^1/_4$). The tincture of digitalis, and alcoholic fluid extract, contain both digitalin and digitoxin; the infusion contains principally digitonin and very little digitoxin. In order to get the full physiological effect it is necessary to use the carefully-selected leaves, according to the pharmacopœial requirements. The seeds, although said by Hitz to contain ten times as much of the active principles as the leaves, are not used in medicine, except possibly pharmaceutically, as a source of digitalin and digitoxin.

Physiological Action.—Digitalis is readily absorbed by the skin, and is thought to have some local sedative effects when used on spongiopilin or in a cataplasm. Although it has a bitter taste, digitalis has no tonic action upon the stomach, but, on the contrary, often disorders the digestion, and may cause nausea, vomiting, or diarrhœa when too long continued. Its active principles readily diffuse into the blood, reducing the rate of the heart's action by lengthening the period of rest, or asystole, thus allowing its cavities to receive more blood. At the same time that it increases the inhibition it stimulates the motor ganglia and increases the force of the contraction. Moreover, digitalis causes the contraction of the arterioles throughout the body, and thus combines its effects with the preceding, in order to raise arterial tension. François Frank, from a series of experiments with digitalis and digitalin, found that, in mammifera, it slows the beat of the accelerated heart, it regulates the arhythmical heart, and it greatly augments the systolic power and the diastolic resistance. He holds that these effects are developed equally on the two sides of the heart, contrary to the view of Germain Sée, and contrary to the German physiologists, who hold that the drug's power is manifested on the left heart. In a toxic dose digitalin produces, first, an excessive slowing of the heart movement, but a special arhythmical beat, manifested by the dicrotic pulse. Afterward the heart accelerates itself, becoming irregular; the contractions are precipitated by a sort of semitetanic, ventricular movement, interrupted by prolonged intermissions, finally causing death, in systole, in both cold- and warm- blooded animals alike.[1] Germain Sée has ascertained that exhausting diseases occasion flaccidity of the cardiac muscle, with consequent dilatation of the organ. In such condition digitalis diminishes the volume of the heart, but acts especially upon the fibres of the right cavities. The temperature is reduced by it in pyretic conditions, though not in health. The slowness of its action (requiring from thirty-six to forty-eight hours) in reducing fever and its likelihood of disturbing the stomach tend to preclude its use for this purpose in acute fevers. Its action upon the circulation may be summed up as being that of a vascular stimulant, raising arterial pressure, lowering abnormal temperature, and steadying the heart. Upon the brain and spinal cord it produces little direct effect. The reflex action of the spinal cord is reduced by large doses, and there is stimulation of the pneumogastric and vasomotor nerves. It is liable to cause headache, delirium, and vertigo, possibly from

[1] *Bulletin de l'Académie de Médecine*, July 2, 1895.

disturbance of the cerebral circulation due to the effects of the volatile oil, or from sick stomach. Syncope may be due to heart-failure from overstimulation after the drug has been used for some time, especially if the patient suddenly sits up in bed or assumes an erect posture. It stimulates the vasomotor ganglia in the medulla. Large doses excite Setschenow's centre and produce muscular paralysis, the peripheral nerves, both motor and sensory, being also paralyzed. Respiration becomes feeble and more rapid, coma and convulsions follow, and death is attended by systolic arrest of the heart's action, from its tetanizing effect upon the cardiac muscle or from exhaustion of motor ganglia. The general action upon muscular tissue is to lessen contractility and cause lassitude and want of vigor. The sexual functions are depressed. The effect upon the kidneys is peculiar. The increase of arterial tension in the glomeruli accompanying the general effect on the circulation is assisted by a special action, by which the renal arteries are dilated, thus acting as a true diuretic; while the excretion of urea is at first increased, it subsequently diminishes. The greatest effect as a diuretic is obtained in diseased conditions accompanied by œdema and low arterial pressure. Digitalis also has some effect upon the muscular tissue of the uterus, stimulating it to contraction.

Aconite and digitalis are antagonistic. The former slows the heart by expanding the peripheral vessels and lowering blood-pressure; the latter reduces the number of contractions by stimulating the inhibitory fibres of the pneumogastric nerve, and tightens up the arterioles, thus causing increased blood-pressure. Aconite directly lowers the action of the cardiac motor ganglia, and is a cardiac poison; digitalis indirectly exhausts the motor ganglia by permitting overaction and exhaustion; in the former, the heart is found, after death, in a condition of dilatation or asystole; in the latter, it is in a state of contraction or systole. The action of aconite upon the heart is rapid; the action of digitalis is gradual and slow; so that the latter is not a practical antidote for the other. An erythematous, papular, or erysipelatous rash will occasionally follow either the internal or external use of digitalis.

Poisoning.—When digitalis or digitalin has been taken by mistake in an overdose, tannin or infusion of tea or coffee should be given at once, the stomach washed out and stimulants given. Saponin is the physiological antagonist, according to Bartholow. The compound tincture of cinchona might be useful, as it contains tannin, alcohol, and quinine. Ferrous sulphate or tincture of ferric chloride should also prove useful. The patient should be kept in a recumbent posture; hot drinks and hot-water bottles should be around him and spirit of ammonia inhaled. As long as the functions of the kidneys are maintained, it has been observed that symptoms of so-called "accumulation" are not apt to arise. As already explained, these are attributed to overstimulation and exhaustion of the heart, but possibly there may be a uræmic element in some cases which would require appropriate treatment.

Poisoning from digitalis seldom has a fatal termination, and the maximum dose of digitalis or digitalin is not at present known. It is important to note that digitalis is more active when given hypodermically than when taken into the stomach. Thus, Piotrowska found that Homolle and Quevenne's digitalin in the frog is three times less toxic by the gastro-intestinal canal

than subcutaneously; Nativelle's digitalin is one and a half times less toxic given by the mouth than under the skin.

Therapy.—Locally, digitalis is employed combined with moisture and heat in joint inflammation, acting as a sedative and possibly reducing the calibre of the vessels. Part of it is absorbed and carried to the kidneys, where it produces a diuretic effect, especially when the hot application is made over the loins. A tablespoonful or more of tincture of digitalis may be sprinkled upon spongiopilin, or flannel wrung out of hot water, and applied to the lumbar region; or a cataplasm containing 4 Gm. (or ʒj) of the leaves, applied in cases of dysuria or suppression of urine. Bronchial congestion due to heart disease may also be relieved by the local application of digitalis.

Dr. Pilatte has found the local application of digitalis serviceable in chilblains. The formula of which he makes use is:—

℞ Tinct. digitalis	6	c.cm. or fʒiss.
Thymol. cryst.	3	Gm. or gr. xlv.
Alcohol (70°), Glycerin aa	135	c.cm. or fʒivss.

M. Sig.: Apply with friction.

Internally, it is chiefly prescribed, almost as a routine practice, as a heart-tonic in all cases of failure of circulation due to the feebleness of the heart's action. It should not be used in valvular disease as long as compensating hypertrophy is keeping up the work of the heart; but when this fails and dilatation is commencing, digitalis will not only slow and steady the heart, but improve the nutrition of the heart-walls by increasing the pressure in the coronary arteries and allowing them a longer time in which to be filled. In heart affections where there is absence of dropsy, and when the patient is passing an abundance of urine, digitalis is seldom demanded. In mitral stenosis digitalis is used in order to allow the left auricle a longer time to empty itself into the ventricle; also, in tricuspid regurgitation, with dilated right ventricle. It is not to be used in aortic stenosis, as a rule, although exceptional circumstances may require its use for a time, to regulate the rhythm of the heart, or to relieve dropsy. On account of the opposing action of the different principles contained in digitalis, Lauder Brunton counsels that when, in disease of the heart, there is excessive constriction of the blood-vessels, digitalis should be given in combination with nitrous ether.

In the course of the second of his Lumleian Lectures[1] Sir Richard Douglas Powell, Bart., M.D., remarked that the commonest mistake that one observes in the use of digitalis is that too large a dose is prescribed at first, which tends to premature arterial contraction and cumulative effects. Then with the appearances of these physiological symptoms the use of the drug is stopped and that of some other medicine substituted until the pulse again calls for its administration. In this hap-hazard way of using digitalis the heart is never held in good control. In exceptional cases, where there is urgent need to push the drug, digitalin is best used subcutaneously. In ordinary cases a dose of 0.60 c.cm. (or *m*x) of the tincture every four hours, or 1 c.cm. (or *m*xv) every eight hours, or 0.30 c.cm. (or *m*v) every waking hour is sufficient. Thus given, the patient being at rest, it generally takes about three days before the pulse is under control and the urine begins to increase.

[1] *Lancet*, April 2, 1898.

When its decided effects are thus gradually developed, the use of the drug should be steadily continued in doses calculated to maintain its effect. With ordinary watchfulness there is no risk whatever; timely warning of excess is given by the pulse, which, having become slow, begins to exhibit small intermediate beats and especially a tendency to go in couples. This is always a sign to reduce the dose or to limit them for a few hours. The sickness that occasionally supervenes with digitalis is most troublesome. An occasional mercurial will sometimes prevent it, a change to digitalin in equivalent doses may be tried, or a tumblerful of very hot water may be taken occasionally. In some cases it is not to be overcome except by omitting the use of the drug; the patient is usually well under the influence of the drug before this symptom appears, in which case a small dose of digitalin by the mouth or hypodermically may be sufficient to maintain its effects on the heart.

Cardiac dyspnœa or asthma due to engorgement of the pulmonary circulation is usually relieved by digitalis; and functional weakness, with irritable heart or low arterial tension, with migraine, or delirium tremens, is very promptly benefited by it. Dr. Jules Comby writes that digitalis is beneficial in congenital maladies of the heart, with or without cyanosis, by strengthening the cardiac contractions, which are almost always insufficient, and by promoting diuresis. He does not, however, regard the drug as serviceable in the case of infants or young children attacked by nervous palpitations.

Large doses (15 c.cm., or f℥ss, or more of the tincture) have been given in mania a potu and acute mania, with success. Isambert records the case of a maniacal child, fourteen years of age, in whom the delirium yielded to the administration of 30 drops of the tincture of digitalis. It is claimed by Gowers that digitalis, associated with belladonna, promotes the efficacy of the bromides in epilepsy.

It is a useful remedy in hæmorrhages, as in menorrhagia or hæmoptysis, and in the first stage of pneumonia. Digitalis is of particular advantage in the metrorrhagia or menorrhagia of plethoric individuals, or when dependent upon mitral disease. For hæmorrhage, the tincture of digitalis may be given in doses of 1.20 to 2 c.cm. (or *m*xx-xxx) every three or four hours. Post-partum hæmorrhage may likewise be restrained by the use of digitalis, which may here be appropriately combined with ergot. This remedy is of service in controlling epistaxis, and is a valuable adjunct to the tincture of iron in purpura hæmorrhagica. In the treatment of hæmorrhages digitalis is usefully prescribed in combination, as:—

℞ Tr. digitalis	6	c.cm. or f℥iss.
Tr. catechu	30	c.cm. or f℥j.
Fluidext. ergotæ	q. s. ad 60	c.cm. or f℥ij.

M. Sig.: A dessertspoonful every hour or two.

The infusion, however, is usually the most efficient preparation in hæmorrhage:—

℞ Plumbi acetatis	2|60	Gm. or gr. xl.
Morphinæ acetat.	|065	Gm. or gr. j.
Infus. digitalis	120|	c.cm. or f℥iv.

M. et ft. sol.
Sig.: Tablespoonful every three hours.

Digitalis may also be prescribed for hæmorrhage in phthisis and in the first stage of pneumonia, thus:—

℞ Extracti digitalis ..... |20 Gm. or gr. iij.
Pulveris ipecacuanhæ et opii ..... 1|55 Gm. or gr. xxiv.
M. et ft. pil. no. xij.
Sig.: A pill every two or three hours.

In persistent diarrhœa complicating fever of a remittent type, Mr. Harold Henley has obtained good results from a combination of digitalis and strychnine given in spirit of chloroform and water.

In exophthalmic goitre and in congestive headaches it sometimes succeeds remarkably in controlling the symptoms of disease. In the treatment of exophthalmic goitre Rockwell values a combination of digitalis, or strophanthus, with iron, ergot, and zinc bromide.

Besides the special action above referred to, as a cardiac tonic or current-regulator to the circulation, digitalis is the chief reliance in dropsy and serous effusions, owing to its diuretic action. In acute renal dropsy, the best effects are obtained by combination with calomel or other mercurial, and with squill, as in the famous Guy's pills:—

℞ Pulv. digitalis ..... |03 Gm. or gr. ss.
Pulv. scillæ ..... |10 Gm. or gr. iss.
Mass. hydrargyri ..... |20 Gm. or gr. iij.
M. et ft. pil.
Sig.: Take one or two at bed-time.

In cases of œdema due to Bright's disease, with scanty albuminous urine, the following are useful:—

℞ Potassii acetatis ..... 26| Gm. or ʒvi gr. xl.
Spiritus juniperi comp. ..... 45| c.cm. or fʒiss.
Inf. digitalis .....q. s. ad 150| c.cm. or fʒv.
M. Sig.: A dessertspoonful every three hours.

℞ Infus. digitalis,
Infus. scoparii,
Infus. buchu ..... aa 60| c.cm. or fʒij.
M. Sig.: A dessertspoonful every three hours.

℞ Infus. digitalis,
Infus. taraxaci,
Spiritus ætheris nitrosi ..... aa 60| c.cm. or fʒij.
M. Sig.: A dessertspoonful every three hours.

Digitalis is of service, in promoting absorption, in pleurisy and hydrothorax. In the bronchitis and broncho-pneumonia of childhood it is often beneficial. Dr. Broadbent observes that as digitalis increases the elimination of fluids and caffeine that of solids, the two agents should be combined in order to obtain the same effect as that produced by a large single dose of digitalis.

In the hæmorrhagic diathesis, the tincture of digitalis is usually given in doses of 1 to 2 c.cm. (or *m*xv-xxx). The same doses may be given in cases of surgical shock or syncope. When the patient is exsanguined, the remedy should be administered by hypodermic injection, preferably in the form of digitoxin.

Spermatorrhœa with nocturnal emissions is benefited by digitalis in combination with ergot or with potassium bromide, according to circumstances. In this country it is not used for its antipyretic effect, although in

Germany it has been given in the hyperpyrexia of rheumatism and scarlet fever. The infusion of digitalis is employed in the treatment of scarlatina, especially when the urine becomes scanty. The following combinations are very serviceable in the latter condition:—

℞ Inf. digitalis,
Spiritus ætheris nitrosi ..... aa 15| c.cm. or f℥ss.
Potassii bitartratis ..... 8| Gm. or ʒij.
M. Sig.: A teaspoonful in water every three or four hours.

℞ Inf. digitalis,
Liquor potassii citratis..... aa 60| c.cm. or f℥ij.
M. Sig.: A teaspoonful every two or three hours.

In fibroid lung, digitalis lessens the cough, steadies the heart, and reduces œdema. It has been successfully employed in erysipelas.

Digitalis is the physiological antidote to muscarine and to aconite, but requires the aid of diffusible stimulants on account of its slowness of action, when treating cases of poisoning by these agents. It may be administered hypodermically in such cases as the official tincture in combination with whisky, and in surgical shock as recommended by Dr. Thomas G. Morton, of the Pennsylvania Hospital, where it is also used in the treatment of sunstroke.

Masius and Van Aubel have used digitoxin with success to fulfill the indications of digitalin. They administered it in the dose of 0.001 to 0.0013 Gm. (or gr. $^1/_{64}$-$^1/_{48}$), and observed no ill effects upon the digestive functions. Its action is said to be prompt and decided and its effect upon the circulation is manifested within twelve or twenty-four hours. The influence of the remedy usually persists for eight to ten days. In pneumonia it reduces temperature within twenty-four to forty-eight hours. Digitoxin relieves the cyanosis and dyspnœa of cardiac affections, restores force and regularity to the pulse, and occasions marked diuresis. It was found useful, likewise, in typhoid fever.

Contraindications.—M. Lucas Champonniére states that the indications for digitalis being frequency, irregularity, weakness of pulse-beat, and dropsy, it can be said in a general way that any other condition forms a contraindication. Among the special circumstances opposing its use are the following: a slow pulse, due to weakness of the heart-wall; an incompetent aorta, dyspepsia, any form of cachexia, also where digitalis has already been used for some time. Death from digitalis happens chiefly in cases of Bright's disease, arthritism, severe anæmia, aortic incompetency, and delirium tremens. In tricuspid insufficiency, digitalis may indirectly cause pulmonary apoplexy, owing to sudden increase of pressure.

Digitalis should be given with great care, if at all, to persons with fatty degeneration of the heart and dilatation. It should not be given in pericarditis, although passive pericardial effusion may be removed without much danger. In simple hypertrophy, or compensating hypertrophy, or conditions of high arterial tension or vascular excitement, it should rarely, if ever, be given. In any disease accompanied by changes in the heart-muscle or atheroma of the blood-vessels, digitalis should not be prescribed except for a temporary emergency. In simple dilatation of the heart, however, this remedy serves an excellent purpose. In typhoid fever digitalis is liable to in-

crease the diarrhœa and cause vomiting. In gastritis or acute nephritis it would also prove injurious.

Digalen, or Digitoxinum solubile (Cloetta), is a recent introduction, and is claimed to have especial application for subcutaneous injection. It is marketed only in solution, by the manufacturers.

DIONIN is a morphine derivative, and, chemically, is ethyl-morphine hydrochloride. It is a white, microcrystalline powder of a somewhat bitter taste. It is soluble in about 7 parts of water and 1.4 of alcohol, and in about 20 parts of syrup. It is neutral, and is precipitated from solution by the usual alkaloidal reagents. Dionin is less narcotic than morphine, and more so than codeine. It has decided analgesic action, and is said to have no noteworthy effect upon the digestive tract and to be free from disagreeable by-effects. It has been used in bronchial asthma and the irritating cough of phthisis, and especially as a substitute for morphine in overcoming the habit. The usual dose is a little larger than that of morphine, and it may be given either by the mouth or hypodermically. Dose, 0.015 to 0.06 Gm. (or gr. $^1/_4$-j) several times daily. For a child, one year of age, give 0.0005 Gm. (or gr. $^1/_{120}$).

DIOSCOREA VILLOSA.[1]**—Wild Yam.**

Pharmacology. — Dioscorea villosa (Dioscoreaceæ), wild yam or colic root, grows abundantly in our Southern States, but less plentifully in the Northern and Western States. The part made use of is the rhizome. This is without odor when intact, but when bruised develops a slightly woody smell. The taste is somewhat pungent and sweetish-bitter. The powdered root is yellowish-gray in color, is soluble both in water and alcohol. The following preparations are used in medicine: Decoctum dioscoreæ (decoction of dioscorea); dose, 30 to 120 c.cm. (or f℥i-iv). Tinctura dioscoreæ (tincture of dioscorea); dose, 0.60 to 2.50 c.cm. (or *m*x-xl). Fluidextractum dioscoreæ (fluid extract of dioscorea); dose, 0.30 to 2 c.cm. (or *m*v-xxx).

The root contains an active principle called **Dioscorein,** also a resin and a substance like saponin, which cause its acridity. The physiological action of the drug has never been systematically studied.

Therapy.—Wild yam possesses diaphoretic and expectorant properties, but derives its principal value from its effect upon the hepatic functions. In large doses it is emetic. It is of especial service in the treatment of gall-stone. It quickly relieves pain and spasm, and, provided the calculus or calculi are not of extreme size, leads to their prompt expulsion. After the concretions have passed into the bowel this remedy is of service in reducing the congestion or inflammation which they have caused.

Hepatic indigestion, with its train of evil consequences, is effectually relieved by the fluid extract in 1 c.cm. (or *m*xv) doses before meals. The same preparation effects a marked improvement and gradual cure in chronic congestion of the liver. In chronic malaria, this agent is of decided advantage and may be combined with arsenic, quinine, or nux vomica.

In chronic gastritis, the result of alcoholic excess, wild yam is very serviceable, and may be prescribed thus:—

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[1] See paper by the author, in *Journal of the American Medical Association,* Sept. 21, 1889.

℞ Tinct. belladonnæ foliorum ..... 1|50 c.cm. or *m*xxiv.
Tinct. nucis vomicæ ..... 4| c.cm. or f3j.
Tinct. dioscoreæ villosæ ..... 15| c.cm. or f℥ss.
Syrupi zingiberis ..... 75| c.cm. or f℥iiss.
M. Teaspoonful in water every fourth hour.

DIPTERYX.—The prepared ripe seeds of several species of Coumarousea, or Dipteryx (Leguminosæ), are also known as Tonka beans, the fruit of a tree of tropical America. The most important constituent is **Coumarin** (1.5 to 2 per cent.), which has a pleasant odor like vanilla. Upon the human subject, it is antispasmodic. In full doses, it depresses the heart after preliminary stimulation.

Coumarin is used as a flavoring agent, and has been added to iodoform to disguise the penetrating odor of this drug. A fluid extract of dipteryx has been used in the treatment of whooping cough; dose, 0.3 to 0.6 c.cm. (or *m*v-x). Comarin may be useful in colic and in disorders of digestion.

DITA.—Dita-bark (Apocynaceæ) is from the East-Indian Archipelago. It contains two bitter alkaloids, **Ditain** and **Ditamine**; has been used as an antiperiodic in treatment of ague; and is said to be of value in dysentery. The dose is 4 to 15.5 Gm. (or 3i-iv), best given in the form of a fluid extract.

DIURETIN.—(See **Theobromin.**)

DRACONTIUM.—Skunk-cabbage. The dried rhizome and roots of Spathyema fœtida (Araceæ), a herbaceous plant of North America. The bruised leaves have a very disagreeable smell, which warrants its common name. Besides this volatile principle the drug contains a resin, tannin, etc.

Therapy.—It is regarded as an antispasmodic, and has been used in chorea and hysteria, asthma, and chronic catarrh, using the recently-dried root or a good fluid extract (two-thirds alcoholic). The dose is 0.65 to 4 Gm. (or gr. x-3j).

DROSERA.—Sundew. The Drosera rotundifolia (Droseraceæ), growing in Europe and North America, has a very limited use in medicine. The entire plant is used, and a recent infusion or fluid extract is the best method in which to administer it. It contains a resin, a red coloring matter, and, according to G. Stein, citric acid.

Physiological Action.—Drosera is irritating to the skin, and the juice is used as an application for corns or warts. Internally, it is expectorant.

Therapy.—It is used in chronic bronchial catarrh, and has some reputation in the treatment of phthisis. In spasmodic affections of the chest, whooping-cough, and paroxysmal asthma it is said to be serviceable. The fluid extract, in doses of 0.30 to 1 c.cm. (or *m*v-xv), is the best preparation. A tincture is also used in the dose of 1 to 4 c.cm. (or *m*xv-f3j). Drosera has been employed with advantage in hay asthma, gastric catarrh, gastric ulcer, and atonic dyspepsia.

DUBOISIA,—Duboisia.

Pharmacology.—The leaves of the Duboisia myoporoides (Solanaceæ), of Australia, have a bitter, acrid taste, but very slight odor, and contain an alkaloid, **Duboisine** (now regarded as being identical with hyoscyamine), with a little **Hyoscine.** It also contains a very small proportion of **Pseudo-**

hyoscyamine. The following preparations have been employed: Tinctura duboisiæ (tincture of duboisia); dose, 0.30 to 0.60 c.cm. (or *m*v-x). Extractum duboisiæ fluidum (fluid extract of duboisia); dose, 0.60 to 1.20 c.cm. (or *m*x-xx). Extractum duboisiæ (extract of duboisia); dose, 0.01 to 0.03 Gm. (or gr. $^1/_6$-$^1/_2$). Duboisinæ sulphas vel hydrobromas (duboisine sulphate or hydrobromate); dose, 0.0004 to 0.002 Gm. (or gr. $^1/_{150}$-$^1/_{30}$).

Physiological Action.—The effects of duboisia are the same as those of belladonna, although, on account of its greater solubility, its effects are manifested more quickly and pass away sooner than those of belladonna. Duboisine may cause loss of appetite, headache, giddiness, and the symptoms of belladonna poisoning. According to Evensen, duboisine will sometimes give rise to hallucinations of sight. Loiacono and Masuro, in a number of cases of epilepsy, observed improvement in two-thirds of the cases from the use of duboisine sulphate. Birnabee has found this remedy injected daily serviceable in the morphine habit. The craving for morphine seemed to be destroyed. Experience has shown that the frequent administration of duboisine exerts a deleterious influence upon nutrition, irrespective of whatever digestive derangement it may occasion. The presence of gastro-intestinal disorder aggravates its depressant effect upon the nutritive processes. The drug must, therefore, be administered with caution to persons of feeble constitution.

Therapy.—It is used in medicine for the same purposes as belladonna, and is antagonistic to morphine. In ophthalmology a watery solution of 1 per cent. may be instilled for making examinations, etc. Its effects upon the pupil pass off more quickly than a similar solution of atropine. Various nervous disturbances occasionally follow the use of a collyrium containing duboisine: faintness and strange sensations in the head, as in Dr. Seely's case, and a feeling of impending death, giddiness, pain over the heart, and hallucinations, as in a case reported by Aubone.[1] Crouzet met with a case in which the application of duboisine to the eye gave rise to frequent pulse, extreme weakness, rise of temperature, and disturbances of speech similar to those of aphasia.

Duboisine has been found useful as a sedative in cases of alienation accompanied by restlessness and great mental excitement. Dr. H. Gellhorn has lately published a communication upon the use of duboisine sulphate in various forms of cerebral disease. He administers the drug both by the mouth and hypodermically, the dose for injections being from 0.0008 to 0.0013 Gm. (or gr. $^1/_{80}$-$^1/_{50}$) for women and 0.0013 to 0.002 Gm. (or gr. $^1/_{50}$-$^1/_{30}$) for men. In a few instances slight pain was caused by the injections, but abscesses or extensive infiltration were not observed. The cases in which a favorable action was witnessed were progressive paralysis, senile dementia, secondary imbecility, hallucinations, idiocy, acute melancholia, periodic mania, hallucinations from injury, and alcoholo-nicotinism. Dr. Gellhorn esteems this preparation as a prompt sedative in cases of alienation attended with excitement. It possesses the advantage over hyoscine of being less dangerous. A rapid subsidence of the tremor of paralysis agitans, according to Dr. Mendel, of Berlin, follows the hypodermic injection of duboisine. The effect continued for several hours. Professors Albertoni, Belmondo, and Samuely have witnessed a notable effect upon the convulsions

[1] *Medical Bulletin*, Jan., 1890, p. 14.

of hystero-epilepsy, produced by the injection of 0.00046 Gm. (or gr. $^1/_{130}$) of duboisine sulphate.

The effect of the remedy may not be at once apparent, but may be postponed to the second or third day. To correspond with this slowness of action, its influence is generally continued for a considerable period. Duboisine is, in general, more efficient in chronic than in acute insanity. It is not adapted for use as a general hypnotic, as the sleep which it produces is not of a refreshing character. It has, however, a beneficial effect as an hypnotic in cases of insomnia caused by intense motor excitement.

DULCAMARA.—Dulcamara (Bitter-sweet).
Dose, 2 to 4 Gm. (or gr. xxx-3j).

Preparation.

Fluidextractum Dulcamaræ.—Fluid Extract of Dulcamara. Dose, 2 to 4 c.cm. (or *m*xxx-f3j).

Pharmacology.—The dried young leaves of Solanum Dulcamara (Solanaceæ) are official in most pharmacopœias, but not in the United States Pharmacopœia. A decoction may be made (1 to 16). A substance exists in this plant which yields a bitter alkaloid, **Solanine**, crystallizing in white needles, readily soluble in alcohol, less soluble in water; its salts are soluble in either alcohol or water. It also contains a bitter glucoside, **Dulcamarin.**

Physiological Action.—Eruptions upon the skin attended by duskiness and itching are among the effects of poisoning, which is likely to occur in children, from eating the berries. It also causes vomiting, dizziness, convulsive attacks, abdominal pains, thirst, heat and dryness of the throat, rapid respiration and pulse, and prostration of vital powers. In the ordinary doses it does not produce these effects, but acts as a sedative and mild narcotic.

The treatment in cases of overdose would be large amounts of warm water and mustard to wash out the stomach, and hypodermic injections of morphine and atropine, with diffusible stimulants by the mouth.

Therapy.—Dulcamara is seldom used at present, although it is believed to be serviceable in chronic skin affections of a scaly character. The recent decoction may be used as a diaphoretic in rheumatism, or acute bronchitis and colds. A distinct anaphrodisiac effect has been noted in patients during the administration of dulcamara. The extract may be given in mania, and especially nymphomania or satyriasis.

Desnos has reported favorably concerning the use of solanine in painful affections of the stomach. He usually administered it in pill form and in doses of 0.045 Gm. (or gr. $^3/_4$) half an hour before meals. If the pain is very severe, the remedy may be beneficially given in gummy solution. Solanine was found of service in gastralgia, painful dyspepsia, alcoholic gastritis with or without dilatation of the stomach, ulcer of the stomach, and cancer of the pylorus. Good results have also been reported from the use of solanine in various forms of neuralgia, in locomotor ataxia, asthma, muscular rheumatism, chronic bronchitis, and the vomiting of pregnancy.

It is claimed that dulcamara is beneficial in the diarrhœa of children, when this condition is caused by exposure to cold or damp.

ECHINACEA.—Echinacea angustifolia, a plant growing in our Western States, is said to possess active therapeutic properties, especially as an anti-

septic. A tincture made by macerating 1 pound of the fresh root in 1 pint of alcohol has been used, diluted with water, as a local application to chronic ulcers, abscess-cavities, and wounds. Internally, in doses of 0.60 c.cm. (or 10 drops), it is recommended in cholera infantum and cholera morbus. It is also reported to be useful in typhoid fever, malarial fevers, measles, small-pox, erysipelas, diphtheria, boils, and carbuncles. The tincture has been used with asserted success in the case of several individuals who had been bitten by rabid dogs. In some cases it seems to be prophylactic, while in others it favorably modified the symptoms. It is said to be an antidote to bites or stings of venomous insects or reptiles.

EIGON.—Eigon is the generic name given by Dieterich[1] to a group of compounds of albumin with iodine in stable combination. The preparations are intended to replace the iodine preparations hitherto used, both internally and externally. The following are to serve as a basis for various medicinal preparations: **Alpha-eigon,** occurring as a light-brown, odorless, tasteless, and insoluble powder, containing 20 per cent. of combined iodine, which is liberated by both acids and by alkalies, more readily, however, by acids; alpha-eigon sodium (sodium iodoalbuminate), an almost colorless, odorless, and nearly tasteless powder, containing about 15 per cent. of iodine, soluble in cold, but more readily so in hot water, and principally intended to replace potassium and sodium iodides; **beta-eigon** (iodized peptone), with properties similar to those of the above-mentioned preparations, but specially intended for use where large quantities of iodine are required to be ingested, and a more ready and rapid absorption required because of weakened digestive functions or of gastric affections. Five parts of alpha-eigon sodium are equal, in iodine-content, to 1 part of potassium iodide; and 5 $^1/_2$ parts are equal to 1 part of sodium iodide.

Tischer and Beddies studied the effect of topical application of alpha-eigon in wounds of various descriptions, and report that it manifested a prompter and more satisfactory action than iodoform. It was found very satisfactory in boils, felons, and tuberculous and venereal processes of the skin. The authors also used alpha-eigon sodium and beta-eigon internally, in malignant syphilis, syphilitic laryngitis, scrofula, and tuberculous lung trouble. The doses were 3 Gm. (or gr. xlv) a day, gradually increased to 10 Gm. (or gr. cl) daily, taken in malt extract or wine.

ELASTICA (U. S. P.).—**India Rubber (Caoutchouc, Liq.).**

CAOUTCHOUC (B. P.).—**India Rubber.**

Preparations.

Emplastrum Adhæsivum (U. S. P.).—Adhesive plaster. (India rubber, 20 parts; Petrolatum, 20 parts; Lead-plaster, 960 parts.)

Liquor Caoutchouc (B. P.).—Solution of India Rubber (India rubber, 50 Gm.; benzol and carbon bisulphide, each, 500 c.cm.).

Pharmacology.—"The prepared milk-juice of several species of Hevea (Euphorbiaceæ: Hevea brasilliensis, B. P.) known in commerce as Para rubber." India rubber occurs in cakes or balls, or hollow, bottle-shaped masses; externally brown or brownish-black, internally of lighter tint. It is dense,

[1] *Pharmaceutische Centralhalle,* xxxiii, p. 183.

very elastic, and, when pure, or nearly pure, floats on water. It is quite insoluble in water, diluted acids, or dilute solutions of alkalies, but is soluble in chloroform, carbon disulphide, oil of turpentine, benzin, and benzol. If heated to 125° C. (257° F.), it will melt, remaining soft and adhesive after cooling. Odor faint, peculiar; nearly tasteless.

Is used in pharmacy for making rubber adhesive plasters. The rubber bandage is used in surgery.

ELATERINUM (U. S. P., B. P.).—**Elaterin.**

ELATERIUM (B. P.).—**Elaterium.**

Preparations.

Trituratio Elaterini (U. S. P.).—Trituration of Elaterin (1 to 9 milk-sugar). Dose, 0.006 to 0.04 Gm. (or gr. $^1/_{10}$-$^2/_3$).

Pulvis Elaterini Compositus (B. P.).—Compound Powder of Elaterin (1 to 39 milk-sugar). Dose, 0.065 to 0.25 Gm. (or gr. i-iv).

Pharmacology.—Elaterin is "a neutral principle obtained from Elaterium: a substance deposited by the juice of Ecballium Elaterium (Cucurbitaceæ)" (U. S. P.). The active principle of Elaterium (B. P.). The freshly-expressed juice of the fruit of the squirting cucumber, upon standing, deposits a peculiar, resinous substance, which, when collected upon muslin and dried, forms flat pieces of variable thickness and irregular shape, of a pale-green or grayish color, mostly amorphous, but containing some crystals. This constitutes commercial, and formerly official, elaterium. **Elaterinum** exists in the proportion of from 15 to 40 per cent. in elaterium. On account of this variability in strength the latter has been dropped from the U. S. P., and the more reliable elaterin substituted. The elaterin is extracted from elaterium by chloroform and precipitated from the chloroform solution by the addition of ether, in which it is nearly insoluble. In prescribing, elaterin must not be dispensed for elaterium, as it is from two to six times stronger. Elaterin in crystalline, odorless, intensely bitter and acrid, soluble in chloroform, fusel-oil, or carbon disulphide, and in 125 parts of alcohol. It is a neutral substance, and is not precipitated by tannic acid or by salts of mercury.

Physiological Action.—Elaterin is violently purgative, causing profuse, watery stools with griping, and in large doses producing great prostration. Death has resulted from excessive doses. Dangerous symptoms require demulcents, opiates, and stimulants. It must be used with caution in elderly persons. It purges when injected hypodermically, but to obtain its full effects it must be mixed with the bile. It also occasions an excessive flow of saliva.

Therapy.—In ascites, uræmia, cerebral congestion, pulmonary œdema, and poisoning by narcotic substances, elaterin affords a ready means of evacuating the bowels, and of reducing the volume of circulation by draining water from the vessels, or "bleeding through the tissues." It should not be given for ordinary constipation, as it is too depressing. On account of its great activity a small fraction of a grain may produce collapse from hypercatharsis. It is not safe to begin with a dose larger than 0.003 Gm. (or gr. $^1/_{20}$). The trituration, therefore, in which the drug is reduced by triturating it with 9 parts of sugar of milk, is an eligible and useful preparation. According to Dr. Hyde Salter, a small dose of elaterin, given on alternate mornings, is of value in dropsy dependent on aortic disease.

ELECTROZONE.—An antiseptic solution obtained from sea-water by partial decomposition by electricity, the chlorides and bromides being converted into hypochlorites and hypobromides.

ELEMI.—The concrete, resinous exudation from Canarium commune (Burseraceæ). This is a tree of the Philippine Islands and other tropical localities which affords an oleoresin, obtained from incisions into the living bark. Elemi somewhat resembles granular honey when fresh, becomes more solid and friable when kept for some time. The taste is rather pungent and bitter. It contains 60 per cent. of amorphous resin, **Brein**; 25 per cent. of crystallizable resin, **Amyrin** (*a*, **Amyrin**, and *b*, **Amaryn**); about 10 per cent. of a volatile oil, besides a crystallizable, bitter, acrid substance, **Bryoidin**; also, brëidin and elemic acid.

Physiological Action.—It has stimulating and irritating properties, and is only used as an ingredient in plasters and ointments, or for use externally. It is similar to other terebinthinate agents in its effects. The British Pharmacopœia recognizes an ointment of elemi, composed of 8 Gm. (or ʒij) of elemi and 31 Gm. (or ʒj) of simple ointment.

Therapy.—Used as an application to enlarged joints, and as a resolvent to swollen glands. It may also be applied to indolent ulcers, and is a good dressing for burns, blisters, and chilblains.

EMBELIA RIBES. — Babarang. The Embelia ribes (Myrsineæ) is a climbing plant of southern China, eastern India, and Malaya. The dried and powdered fruit is used, or the fluid extract of the fruit (dose, 4 to 15 c.cm., or fʒi-iv). It is an efficient anthelmintic and tæniacide; is believed to be a specific in rheumatism; and is an alterative in chronic skin diseases. In cases of flatulent dyspepsia it is claimed to be serviceable. The active principle was found to be an acid, which has been named **Embelic Acid** (Warder), and is insoluble in water. It forms salts with soda, potash, and ammonia, the latter being most readily obtained crystalline.

Ammonium embelate occurs in the form of red needles or powder devoid of taste. This ammonium salt was found effective as an anthelmintic against tænia, in doses of 0.38 Gm. (or gr. vj) for adults, or 0.20 Gm. (or gr. iij) for children. It is administered in syrup, to be followed by castor-oil. It has the advantages over male fern of smallness of dose and tastelessness. It kills the worm. The powdered seeds may be given with milk early in the morning, fasting, followed by a purgative some hours later. The dose of the powder for a child is 4 Gm. (or ʒj), twice a day, as a tæniacide, or about the same quantity of a fluid extract.

EPHEDRA.—Mormon Tea. The stems or the whole herb of Ephedra antisyphilitica (Gentianaceæ) is used in Arizona as a recent infusion, or in the form of fluid extract (dose, 4 to 7.5 c.cm., or fʒi-ij) as an alterative, and especially in the treatment of gonorrhœa and syphilis. It contains a peculiar kind of tannin, to which its effects are probably attributable, according to Prof. Oscar Loew's analysis; although in a Japanese variety, E. vulgaris, Professor Nagai discovered an alkaloid, which he named **Ephedrine.**

The physiological action of ephedrine has been studied by Professor Bogoslowski, who concludes that it influences especially the motor apparatus of the heart and probably also the cardiac muscle. It at first reduces blood-

pressure temporarily and accelerates the pulse, but arterial pressure is finally elevated and the pulse retarded. The respiration is quickened in the beginning by small doses, but, under the influence of larger amounts, sooner or later becomes slow and irregular. The pupils are dilated and salivation occurs. Professor Bogoslowski places the active dose of the alkaloid at 0.10 to 0.50 Gm. (or gr. iss-vss) for adults. The best preparations for use are the fluid extract and the ephedrine hydrochlorate.[1] The alkaloid occurs in the form of colorless crystals. Ephedrine hydrochlorate is also colorless and is soluble in water.

Ephedrine, in 10-per-cent. solution, is a mydriatic, dilating the pupil without irritation in forty to sixty minutes. Under the name of **Mydrin** a combination of ephedrine and homatropine has been employed, and is esteemed particularly serviceable for diagnostic purposes on account of the transitory character of its action. Mydrin is a white powder, soluble in water. It is used in the strength of 10 per cent.

Therapy.—Dr. H. H. Rusby[2] is satisfied that the reputation of this drug as a remedy in gonorrhœa and in syphilis has some solid foundation. As an antiblennorrhagic its action is probably very similar to that of astringents now in use. As a remedy in syphilis, he says, its value is, probably, solely that of a depurative. In the removal from the system of the accumulated products of the disease, ephedra will take rank with any agent now in use, with the single exception of potassium iodide, and it may well serve to alternate or combine with that drug. It is also considered by persons living in the region of its growth to be a "sure and speedy cure for skin diseases."

Ephedra vulgaris has long had a popular reputation in Russia as an antirheumatic remedy. Clinical experiments by Dr. Bechtine in the service of Professor Popow showed it to be of value especially in acute articular and muscular rheumatism. It was also found to have some laxative effect and to act as a decided diuretic.

EPIGÆA.—Trailing Arbutus. The Epigæa repens (Ericaceæ) is a small, herbaceous plant, with sweet-smelling flowers. The part used is the leaves, which are odorless, bitter, and astringent. They contain **Arbutin, Ursone,** and tannic acid.

Therapy.—The constituents of the plant are very much the same as those of uva ursi and chimaphila, and its uses are similar. It is given as an astringent in vesical catarrh, blennorrhœa, etc.

EPINEPHRIN. (See **Animal Extracts.**)

ERGOTA (U. S. P., B. P.).—**Ergot (Ergot of Rye).**
Dose, 0.65 to 4 Gm. (or gr. x-3j).

Preparations.

Fluidextractum Ergotæ (U. S. P.).—Fluid Extract of Ergot. Dose, 0.60 to 7.50 c.cm. (or *m*x-f3ij).

Vinum Ergotæ (U. S. P.).—Wine of Ergot (20 per cent.). Dose, 4 to 15 c.cm. (or f3i-iv).

Extractum Ergotæ (U. S. P., B. P.).—Extract of Ergot. Dose, 0.13 to 0.65 Gm. (or gr. ii-x).

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[1] *Medical Bulletin*, Aug., 1894.
[2] *Druggists Bulletin*, 1888, p. 220.

Extractum Ergotæ Liquidum (B. P.).—Liquid Extract of Ergot. Dose, 0.60 to 2 c.cm. (or *m*x-xxx).

Tinctura Ergotæ Ammoniata (B. P.).—Ammoniated Tincture of Ergot. Dose, 2 to 8 c.cm. (or f℥ss-ij).

Injectio Ergotæ Hypodermica (B. P.).—Hypodermic Injection of Ergot (about 33 per cent.). Dose, 0.18 to 0.60 c.cm. (or *m*iii-x).

Infusum Ergotæ (B. P.).—Infusion of Ergot (5 per cent.). Dose, 30 to 60 c.cm. (or f℥i-ij).

Pharmacology. — Ergot is the compact spawn or "sclerotium of the Claviceps purpurea (class, Fungi) replacing the grain of rye, **Secale cereale**, Gramineæ" (U. S. P.). The sclerotium of Claviceps purpurea originating in the ovary of secale cereale (B. P.). The ergot of rye is the only one official, although it also affects other grasses. The Ustilago maidis of corn is very similar in chemical composition and effects. Ergot is in compact masses, from 1 to 2 inches long and about $^1/_8$ inch thick. The grains are nearly triangular, somewhat curved, and marked lengthwise by three grooves, thickest in the middle and tapering toward each end; of a dark-purplish color externally, they are nearly white in the centre. They have a heavy, unpleasant odor, and a fatty, mawkish, disagreeable taste. The addition of a strong alkali develops an odor like that of herring-brine (due to trimethylamin). Ergot contains about 35 per cent. of fixed oil, a peculiar sugar, and two coloring matters. Chemists have isolated or derived a number of more or less active principles, the most important being those which act specifically upon the uterus. **Cornutine** is an alkaloid, insoluble in water and petroleum ether, but soluble in ether, chloroform, and alcohol. It is precipitated from acid solutions by alkalies, but is redissolved in excess. According to Keller the specific action of the drug is due to this alkaloid, which is much more stable than has been supposed by other investigators. Recent physiological tests have demonstrated that the full vaso-constrictor and oxytocic power of the ergot resides in cornutine. It has been observed that a fluid extract of ergot which possessed decided vaso-constrictor activity, lost it entirely when the cornutine was extracted.[1] **Ergotinic Acid** of Kobert has little effect when taken into the stomach, where it is probably decomposed. But when injected hypodermically, it exerts a depressing and paralysant action upon the spinal cord, and to a less degree on the brain. It has a narcotic action, and death occurs from respiratory paralysis. It is claimed to have no effect upon the gravid uterus. Kobert claims that ergotinic acid is the basis of the **sclerotic acid** of Dragendorf, and is the principal ingredient in **Ergotin** (Bonjean). Vahlen reports[2] the isolation of a substance, which does not produce gangrene or convulsions; but has an energetic ecbolic action on the pregnant uterus. This principle he calls **Clavin**; it is soluble in water, microcrystalline, formula $C_{11}H_{22}N_2O_4$. It does not form salts. It has been used by Bumm and by Vahlen, in 2-per-cent. solution by subcutaneous injection, 0.01 to 0.02 Gm. (or gr. $^1/_6$-$^1/_3$), for uterine inertia in labor. The solution should be freshly prepared. **Sphacelinic acid** (probably identical with **Sphacelotoxin**), according to Kobert, represents the portion of the drug causing gangrenous ergotism through its action upon the blood-vessels and vasomotor centres, and acting on the uterus with cornutine in causing contraction of its muscular fibres. A substance similar in composition to

[1] *National Standard Dispensatory*, Philadelphia, 1906, p. 571.

[2] *Deutsch Med. Woch.*, August 10, 1905.

cholesterin, and therefore termed ergosterin, has been extracted from ergot by C. Tanret. As both sphacelic acid and cornutine lose their properties by keeping, it is important to use fresh ergot. After being kept for one year, ergot is unfit for use.

Physiological Action.—No local effects are observed from application of ergot to the skin; upon mucous membranes it acts as an astringent. Upon the nervous system little effect is produced directly, although in ergotism we have convulsions and other nervous symptoms, caused indirectly. It induces anæmia of nerve-centres by exerting a selective action upon their blood-vessels, which it causes to contract. When introduced into the circulation, there is, first, a fall of blood-pressure, soon followed by a rise; the primary fall is most marked where a large amount comes in contact with the heart-muscle, which is depressed by it, and paralysis of the heart may cause death, after intravenous injection of ergot. The secondary rise of blood-pressure represents the effect of the physiological stimulating action of the drug upon the vasomotor centres and upon the unstriped muscular fibres in the arterioles.

The action of ergot upon the uterus is due to a primary influence upon the lumbar cord, according to the experimental study of Hemmeter. It produces intestinal peristalsis and contraction of arterioles and capillaries by a centric action. The effects of ergot upon the parturient uterus are those of a stimulant to the contractions, increasing their force and frequency until the full action is brought about of tetanic contraction of the organ. Upon the non-parturient uterus the effects are more evident in checking the blood-supply. The lower animals abort after eating ergotized grain, and in some States there are laws against the administering of ergot to pregnant women in order to produce miscarriage; but such result does not follow the use of ergot in ordinary medicinal doses, although in chronic ergotism this accident may occur.

Toxic Effects.—When an overdose is administered, effects result which are known collectively as **acute ergotism.** The symptoms are peculiar restlessness, with anxiety, headache, vertigo, dilated pupils, tinnitus aurium, with hyperacusis, the action of the heart is slowed, the pulse is weak, respirations reduced in frequency, and, as the effects increase in intensity, suddenly nausea and vomiting occur, even when the drug is introduced hypodermically. This cerebral vomiting is distinct from the local effects of the drug when taken by the mouth, when vomiting may occur early if the stomach is very sensitive. Coldness of the surface is a prominent symptom and seems to depend upon a general depression of temperature.

Chronic ergotism occurs in regions of the country, notably in Europe, where rye-bread is the staple food, in seasons when ergot is most present in the grain. It appears in two forms, the convulsive and the gangrenous, the former being characterized by vertigo, dimness of vision, and numbness of the extremities, followed by tonic contractions, particularly of the flexor groups of muscles. Attacks of dyspnœa also occur, resembling asthma, caused by tetanoid contractions of the respiratory muscles. Cramps of abdominal muscles, colic, and diarrhœa take place; the pulse is slow and weak; the surface of the body is cold; the symptoms increase in intensity; the special senses are affected; hearing and smell are lost; the pupils are permanently dilated, and vision is impaired. The case may be terminated by clonic convulsions or death result from exhaustion. The gangrenous form is

marked by the intensity of the local phenomena, the numbness of the fingers and toes terminating in vesications, and moist or dry gangrene, more or less extensive, destroys these parts, or may affect the nose or other portions of the body. It is evident that in chronic ergotism there is a profound dyscrasia, perhaps attributable as much to the unhygienic mode of life and poor food as it is to the toxic effects of ergot. Such grave effects are not observed from the medicinal administration of ergot, even when continued for a long time. The prolonged administration of ergot has, however, been known to cause a vesicular, pustular, and furuncular eruption, with petechiæ.

Treatment of Poisoning.—The phenomena of acute ergotism are easily controlled by placing the patient in a hot bath and administering cardiac and arterial stimulants, such as coffee. Amyl nitrite, aconite, veratrum viride, and tobacco antagonize the effects of ergot upon the circulation. The treatment of chronic ergotism is mainly hygienic and symptomatic.

Therapy.—Ergotin made into a paste with water has been employed locally in conjunctivitis, gonorrhœa, endocervicitis, acne rosacea, and incipient boils. Ergot is valuable in hæmorrhoids, prolapsed rectum, and relaxation of the sphincter ani, when applied upon a tent or introduced as suppositories. Incontinence of urine, due to relaxed sphincter, is cured by ergot given in this manner, or administered by the mouth.

By Dr. T. Clemens, ergotin is said to be a valuable remedy in the ammoniacal cystitis of paraplegic patients. The bladder is injected with a solution containing about 4 grains to the ounce, and the drug is, at the same time, administered by the mouth.

Chronic follicular pharyngitis is sometimes improved by the topical application of the fluid extract, or of ergotin in the proportion of 0.65 to 1.30 to 30 c.cm. (or gr. x-xx to f℥j). The oil of ergot is a valuable local medicament in seborrhœa, removing the sebaceous material, and, at the same time, by its astringent and stimulant action, benefiting the diseased follicles and glands. Locally, in congestive conditions, ergot may be prescribed according to the appended formulæ:—

℞ Ext. ergotæ	2		Gm. or ℥ss.
Cocainæ hydrochloridi		32	Gm. or gr. v.
Plumbi carbonatis	2		Gm. or ℥ss.
Ungt. aquæ rosæ	15	5	Gm. or ℥ss.

M. For external use in acne rosacea and in boils.

℞ Ext. ergotæ	4		Gm. or ℥j.
Sulphuris sublimati	2		Gm. or ℥ss.
Mentholi		32	Gm. or gr. v.
Ext. belladonnæ folior		65	Gm. or gr. x.
Ungt. zinci oxidi	15	5	Gm. or ℥ss.

M. Valuable in fissures of the nose, mouth, rectum, and in hæmorrhoids.

℞ Ext. ergotæ		32	Gm. or gr. v.
Camphoræ		65	Gm. or gr. x.
Ext. opii		17	Gm. or gr. iiss.
Plumbi acetatis	1	30	Gm. or gr. xx.
Ol. theobromatis	q. s.		

M. et ft. suppositoriæ no. x.

Sig.: Insert one in the bowel when necessary, for prolapsed rectum, diarrhœa, or for fissure of rectum.

℞ Fluidextracti ergotæ			
Fluidextracti hamamelidis	aa 45		c.cm. or f℥iss.
Glycerini	30		c.cm. or f℥j.

M. Sig.: Apply several times a day for chronic pharyngitis and nasal catarrh.

℞ Olei ergotæ ..... 90| c.cm. or f℥iij.
Adipis lanæ ..... 31| Gm. or ℥j.
Ol. verbenæ ..... |30 c.cm. or *m*v.
Ol. rosæ ..... |18 c.cm. or *m*iij.

M. Sig.: Rub into the scalp well once or twice a day for dandruff. Useful, also, in loss of hair and sycosis.

Ergot is a reliable remedy in the several forms of capillary hæmorrhage, and in overcoming the congestion attendant upon and causing the oozing. In hæmoptysis, epistaxis, hæmaturia, bloody discharges from the bowels (melæna), and in uterine hæmorrhage, ergot in 2 c.cm. (or f℥ss) doses of the fluid extract, repeated every hour or two, will generally promptly cause cessation of the bleeding. Ergot may be prescribed for various hæmorrhages with advantage, combined with geranium and witch-hazel:—

℞ Fluidextracti ergotæ ..... 45| c.cm. or f℥iss.
Fluidextracti geranii ..... 30| c.cm. or f℥j.
Fluidextracti hamamelidis ..... 45| c.cm. or f℥iss.

M. Sig.: A teaspoonful or two every half-hour or hour until bleeding ceases.

Blaschko, of Berlin, employs the following formula in hæmoptysis:—

℞ Ergotin,
Acid. gallici ..... aa 1| Gm. or gr. xv.
Syr. althææ,
Aq. destill. ..... aa 22| c.cm. or f℥vj.

M. Sig.: Teaspoonful every two hours.

Binz considers, however, that the action of ergot in stopping hæmorrhages, other than uterine, is doubtful.

In severe cases of post-partum hæmorrhage a better practice is to administer the fluid extract or ergotin by subcutaneous injection. The same method is preferable when ergot is used in the treatment of fibromyomata of the womb. Where uterine hæmorrhages are due to submucous polypi or fibromyomata, ergot not only checks the hæmorrhages, but may cause the separation and expulsion of the growth; in such cases the progress of the treatment should be accelerated by dilatation of the cervix uteri, incision into the capsule, if one exists, and removal of the growth by surgical operation. In multipara, where there is a history of flooding after previous labors, full doses of ergot should be given just before the delivery of the child. The usual rule for the administration of ergot is to wait until the child's head is upon the perineum before giving it; otherwise there may be an hour-glass contraction, or tetanic contraction with unyielding os, and the child's life be endangered. The administration of 2 to 4 c.cm. (or f℥ss-j) of fluid extract of ergot, after labor has terminated, prevents relaxation of the organ and the formation of large clots, which cause after-pains. An antiseptic preparation of ergot, especially designed for subcutaneous injection, is supplied under the name of **Ergone** (P. D. & Co.). It is standardized, and is kept from spoiling by a little chloretone, which it contains.

In subinvolution of the uterus, Professor Barton Cooke Hirst recommends:—

℞ Strychnin. sulphat. ..... |003 Gm. or gr. $^1/_{20}$.
Quinin. sulphat.,
Ext. ergotæ ..... aa |065 Gm. or gr. j.

M. et ft. pil. no. j. Mitte tales no. xxx.
Sig.: One pill three times a day.

In night-sweats, ergot may be given alone in full doses, or combined with picrotoxin or atropine. This remedy has likewise been found of advantage in the treatment of galactorrhœa. Ergot is often of avail in hyperidrosis. It is efficacious in all varieties of purpura, and in severe cases of the hæmorrhagic form may very properly be hypodermically injected. This drug is of value in the treatment of chronic diarrhœa and dysentery.

In dysentery of children, accompanied by severe pain and excessive tenesmus, the following preparation is beneficial:—

℞ Cocain. hydrochloridi ..... | .065 Gm. or gr. j.
Ext. ergotæ ..... | .65 Gm. or gr. x.
Ext. opii ..... | .13 Gm. or gr. ij.
Thymolis iodidi ..... | .32 Gm. or gr. v.
Ol. theobromatis ..... q. s.

M. et ft. suppos. no. x.
Sig.: One every two or three hours.

℞ Fluidextracti ergotæ,
Fluidextracti hamamelidis ..... aa 45 | c.cm. or f℥iss.
Elix. guaranæ ..... 60 | c.cm. or f℥ij.

M. Sig.: Two teaspoonfuls in water every two or three hours, for an adult.

In passive or hypostatic congestion of the lungs, it may be combined with digitalis with advantage:—

℞ Ext. ergotæ ..... | 25 Gm. or gr. iv.
Extracti digitalis ..... | 20 Gm. or gr. iij.
Pulv. ipecacuanhæ et opii ..... 1 | 55 Gm. or gr. xxiv.

M. et ft. pil. no. xij.
Sig.: A pill every three or four hours.

℞ Ext. ergotæ ..... 1 | Gm. or gr. xv.
Glycerini,
Aquæ destillatæ ..... aa 4 | c.cm. or f3j.
Aquæ phenolis ..... 2 | c.cm. or *m*xxx.

M. Sig.: Inject hypodermically 1.20 to 2 c.cm. (or *m*xx-xxx) from two to four times a day in hæmoptysis.

In diabetes insipidus the fluid extract of ergot produces marked effect on the disease, having a decided influence in controlling the urinary excretion. Favorable results have been claimed in diabetes mellitus from the hypodermic injection of ergotin or ergotinin. It is serviceable in congestive dysmenorrhœa, paralysis of the bladder, congestive form of migraine, and in hyperæmia of the spinal cord. It is claimed that ergot is capable of relieving whooping-cough. Varicose veins are restored to their normal calibre by hypodermic injections of ergotin, and Bartholow strongly recommends this mode of treatment as efficacious in varicocele. The needle should be thrust among the enlarged veins in such a manner as not to wound their walls. Injected into the neighborhood of an aneurism, or administered by the mouth, ergot proves valuable by favoring the coagulation of blood within the sac. Enlarged spleen may be reduced by the same methods. In view of the fact that ordinary pharmaceutical preparations are not aseptic, and that ergot fluid extract cannot be readily sterilized by heat without injury, manufacturers now supply a special form of ergot for hypodermic use, the usual dose being put up, singly, in small hermetically-sealed glass flasks. Each bulb contains 1.20 c.cm. (or *m*xx) of aqueous solution, representing the equivalent weight of ergot.

Ergot combined with iron has very often a beneficial action in enlarged spleen:—

℞ Fluidextracti ergotæ,
Tincturæ ferri chloridi,
Glycerini ..... aa 30| c.cm. or f℥j.
M. Sig.: From one to two teaspoonfuls in water three or four times a day.

From its effects upon the vascular supply of the spinal cord, Brown-Séquard has proposed its use in some forms of paraplegia attended by signs of local irritation and hyperæmia of the cord. It is useful in congestive headache and in chronic mania, and has been used with asserted good result in spermatorrhœa and incontinence of urine. The hypodermic injection of a sterilized fluid extract is said to afford relief in facial neuralgia and in insomnia. In delirium tremens, and the wet brain of drunkards, ergot hypodermically is of great value, according to F. N. Wigger and F. A. Livingston.[1]

From Budapest, cornutine is recommended as having an efficient action upon unstriped muscular tissue, while it is, at the same time, less dangerous than the other constituents of ergot. Pure cornutine is almost insoluble in water. The hydrochlorate, or citrate, is more readily soluble. Dr. Meisels has administered the drug in daily doses of 1 cg. (or gr. $^1/_6$), divided into four portions. In hæmorrhages from the genito-urinary organs cornutine rapidly caused a cessation of the bleeding. He observed it to act promptly in gonorrhœa accompanied by hæmorrhage from the bladder or urethra, in hæmorrhage from cystitis, and during the lying-in period from atony of the womb. Professor Bokai also has given cornutine citrate, with excellent results, in spermatorrhœa of the paralytic type.

When impaired vision depends upon congestion of the retina incident to dilated or hypertrophied heart, and in cases of epilepsy when hemicrania occurs in the intervals of rest, when the pupils are contracted and vision disordered, ergot has been used with advantage. In the treatment of psychoses, associated with intracranial congestion and perhaps inflammation, ergot is a valuable adjunct to other modes of treatment.

ERIODICTYON (U. S. P.).—Eriodictyon (Yerba Santa).

Preparation.

Fluidextractum Eriodictyi (U. S. P.).—Fluid Extract of Eriodictyon. Dose, 1 to 4 c.cm. (or *m*xv-f3j).

Pharmacology.—"The dried leaves of Eriodictyon Californicum (Hydrophyllaceæ)," of California, have a fragrant odor and an aromatic, sweetish taste, and contain about 9 per cent. of a greenish-yellow, acrid, and bitter resin, which forms soluble salts with basis, and unites with quinine to form a crystalline quinine resin. They also contain a small quanaity of amorphous brown **Ericolin,** and also **Eriodictyonic Acid** (crystallizing in yellow plates of sweet-acid taste), and a volatile oil. The effects are most evident in the bronchial mucous membrane, to which it is a stimulant and expectorant. The extract of eriodictyon is not official (made by evaporating the fluid extract to a pilular consistency). Dose, 0.20 to 1 Gm. (or gr. iii-xv).

[1] *Merck's Archives*, April, 1903.

Therapy.—Yerba Santa has a reputation in the treatment of bronchitis, laryngitis, and consumption. It has likewise been found beneficial in asthma, and may be very well administered in conjunction with grindelia robusta. It is used as a vehicle for the administration of quinine, the bitterness being overcome by the aromatic principles of the plant. The National Formulary provides an aromatic syrup of eriodictyon, of which a teaspoonful completely masks the bitterness of 0.13 Gm. (or gr. ij) of quinine sulphate, as in the following formula:—

℞ Quininæ sulphatis	3	10 Gm. or gr. xlviij.
Fluidext. belladonnæ radicis		12 c.cm. or *mij*.
Syrupi eriodictyi aromatici (N. F.	q. s. ad 90	c.cm. or f℥iij.

M. Sig.: A teaspoonful four times daily in laryngitis or chronic bronchitis.

ERYTHROPHLŒUM.—**Erythrophlœum.** (See **Casca Cortex.**)

ESCHSCHOLTZIA. — The Eschscholtzia Californica (Papaveraceæ), or the California poppy, enjoys a reputation upon the Pacific coast of this country as a soporific and analgesic. It is represented by a number of varieties, and it is necessary to obtain the genuine species, as some appear to be inert. It is claimed that it possesses a small amount of **Morphine,** although other principles contribute toward producing its effects, among which is **Sanguinarine.** Professor Schmidt, from his examination of the plant, is unable to confirm the statement that it contains morphine.

Physiological Action.—The effects upon animals are gradual slowing of respiration after a brief preliminary increase of rapidity; death is due to failure of respiration. The effect upon the nervous system is that of a narcotic. The motor nerves are affected before the sensory. The cumulative effects in human subjects resemble those produced by codeine. Though its narcotic effects are not very decided, yet they continue for a considerable period after its discontinuance.

Therapy.—It is claimed that the eschscholtzia is an efficient, though harmless, soporific agent, especially for children. It relieves pain and induces sleep, relieves tremor, and agrees well with the digestive organs. Eschscholtzia, in the form of the fluid extract or the syrup (2 to 18.5 c.cm., of f℥ss-v, at a dose), is a good addition to a cough-mixture where the use of opium is not considered advisable.

EUCAINE, A AND B (**Alpha-eucaine** = Eucaine Hydrochloride "A," and **Beta-eucaine** = Eucaine Hydrochloride "B").—The manufacturers announce that when eucaine is ordered they will hereafter invariably supply beta-eucaine, unless otherwise specified. Both agents are in the form of a colorless crystalline powder, soluble in water. They have been introduced as a safe substitute for cocaine in minor surgery and as a local anæsthetic. Eucaine-B is claimed to be five times less toxic than cocaine and one-third as toxic as Eucaine-A. The solutions should be made with distilled water, and they can be sterilized by boiling. It is said that they will keep an indefinite time without spoiling. A 5-per-cent. solution may be injected into the gums previous to extraction of teeth, and is much safer for this purpose than 2-per-cent. solutions of cocaine. Beta-eucaine is used in Schleich's method of local anæsthesia, also in ophthalmological and laryngological practice for the same purpose that cocaine was used.

Recently eucaine has been used to produce spinal anæsthesia (see **Coca**) by lumbar puncture, allowing the surgeon to perform painless major operations below the diaphragm. It has the advantage over cocaine in that the solution may be sterilized without impairment of its efficacy. Though spinal anæsthesia is of advantage in selected cases, yet the danger attending its use must necessarily restrict its general employment in major surgery.

EUCALYPTI GUMMI (B. P.).—**Eucalyptus-gum.**

Dose, 0.13 to 0.32 Gm. (or gr. ii-v).

A ruby-colored exudation, or so-called red gum, from the bark of the Eucalyptus rostrata, and some other species of eucalyptus. Imported from Australia.

EUCALYPTUS (U. S. P.)—**Eucalyptus Leaves.**

Preparations.

Fluidextractum Eucalypti (U. S. P.).—Fluid Extract of Eucalyptus. Dose, 0.30 to 4 c.cm. (or *m*v-f3j).

Eucalyptol (U. S. P.).—Eucalyptol ($C_{10}H_{18}O$). Dose, 0.30 to 2 c.cm. (or *m*v-xxx).

Oleum Eucalypti (U. S. P., B. P.).—Oil of Eucalyptus. Dose, 0.18 to 1.20 c.cm. (or *m*iii-xx). B. P., 0.03 to 0.18 c.cm. (or *m*ss-iij).

Unguentum Eucalypti (B. P.).—Eucalyptus Ointment (10 per cent.).

Trochiscus Eucalypti Gummi (B. P.).—Eucalyptus-gum Lozenge (0.065 Gm., or gr. j, of red gum with simple basis).

Pharmacology.—The blue gum of Australia is a tall tree that has been of considerable interest to sanitarians, since it is easily cultivated in marshy grounds, and is said to render malarious districts, such as the Campagna, healthy. This is partly on account of the volatile oil and resins of the tree, and partly because it drains the soil of water, the exhalation of water from the leaves being equal in amount each day, on an average, to the weight of the tree. The official portion of the plant (U. S. P.) are "the dried leaves of Eucalyptus globulus (Myrtaceæ) collected from the older parts of the tree." They have a camphor-like odor and a pungent, bitter taste; contain a volatile oil, a crystallizable resin, and some tannin. The official volatile oil is distilled from the fresh leaves of Eucalyptus globulus and some other species of eucalyptus. The oil is soluble in absolute alcohol, and in 3 volumes of 90 per cent. alcohol. It is also soluble in ether, chloroform, and the fatty oils, but does not dissolve in water. It does not become resinous on exposure to the air. The volatile oil, by fractional distillation, is separated into three oils of different density, the lightest and most important being **Eucalyptol** (or **Cineol,** about 50 per cent.), the others being **Pinene** and **Eudesmol.** Pure eucalyptol is officially defined as "a neutral body obtained from the volatile oil of Eucalyptus globulus (fam. Myrtaceæ), and from other sources." It is a colorless fluid and has an odor and taste resembling that of camphor. The fluid extract, being made by percolation with alcohol, is a strong tincture. A medicated water, made like the official waters, is useful as a vehicle for alkaloids for hypodermic use, as it prevents fermentation and deterioration; it is also a vehicle for medicated sprays. Alkalies, mineral acids, and metallic salts (iron, mercury, lead, zinc) are chemically incompatible with preparations of this drug; while tonics, simple and aromatic bitters, essential oils, turpentine, camphor, cubeb, etc., are synergistic, and increase its physiological and therapeutical effects.

Physiological Action.—Eucalyptus is obnoxious to lower forms of life and is a good disinfectant. Applied to the skin, the oil is an irritant, increasing the local blood-supply and partly diffusing into the blood, where it produces systemic disease. The vapor of eucalyptus, inhaled in quantity, also produces systemic effects besides its local action upon the bronchial mucous membrane. In the mouth it is pungent, aromatic, camphor-like, or resembling cubeb in its impressions upon the nerves of taste. Eucalyptus excites the flow of saliva and leaves a disagreeable, hot, astringent flavor. In the stomach a sensation of warmth is felt, and it acts as a carminative and antiseptic; the appetite and digestion improve, and the secretion of the gastric juice and of the intestinal fluids is increased. It favors the evacuation of the bowels, and the alvine evacuations are somewhat more copious. This drug is a diaphoretic and diuretic, the eucalyptol being eliminated largely by the kidneys, but also through the skin and bronchial mucous membrane. Eucalyptus sometimes communicates to the urine an odor which has been likened to that of violets. The excretion of urea is augmented; the action of the heart is increased; the arterial tension is at first increased, then lowered. The respiratory movements are accelerated. Eucalyptus inhibits the amœboid movements of the white blood-cells. Very large doses cause gastric distress, indigestion, diarrhœa, with congestion of the kidneys, the characteristic odor of eucalyptus being recognized in the urine, breath, and discharges from the bowels. The action of the heart and lungs is decreased and the temperature falls. Wakefulness is one of the physiological results, but it may indirectly favor sleep in debilitated conditions of the system. Paralysis of the respiration causes death in the lower animals to which a lethal dose has been given. Its action may be summed up as antiseptic, carminative, digestive, tonic, laxative, diaphoretic, expectorant, and diuretic.

Several cases of poisoning from the oil of eucalyptus have been reported. Dr. Alfred Neale, of New Norfolk, Tasmania, observed a fatal case, death being preceded by great embarrassment of respiration. A large quantity of blood was found in the pleural cavities, the lungs were collapsed and bloodless, and the right heart contained frothy blood. A fatal case has recently been reported from England.[1] A man, 34 years of age, swallowed six drachms with an equal quantity of hot water. He soon became unconscious, and died two days later with acute congestion of the lungs.

Therapy. — Eucalyptus is used as an antiseptic in the treatment of wounds and ulcers, acting as a substitute for carbolic acid. An ointment of eucalyptus is official in the British Pharmacopœia, which is a good dressing to chronic, indolent, or unhealthy ulcers. The tincture, or the water, of eucalyptus may be used externally for the same purpose. A combination of eucalyptus and iodoform is a serviceable application to chancres and chancroids. The oil is a very useful *addendum* to preparations for the relief of chronic eczema, in which the following combination is often found beneficial:—

℞ Hydrarg. ammoniat.	1|	Gm. or gr. xv.
Olei eucalypti	|50	c.cm. or *m*viij.
Betanaphthol	|65	Gm. or gr. x.
Pulv. marantæ	8|	Gm. or ʒij.
Unguent. zinci oxidi	31|	Gm. or ʒj.—M.

[1] *Journal of the American Medical Association*, February 17, 1906, p. 524.

The vapor may be used by dropping the oil upon hot water, or upon cotton-wool placed in an inhaler; or the steam-atomizer may be employed with eucalyptol-water for inhalation in phthisis, dilated bronchial tubes, bronchial catarrh with fetid expectoration, etc. Applied directly to the diseased membrane, or inhaled in a vaporized state, the oil is a good antiseptic in diphtheria. As a local application in diphtheria, Dr. Marion Thrasher, of San Francisco, uses a 10-per-cent. solution of eucalyptol in pure alcohol. One part of the oil to 50 of plain or medicated water, may be advantageously used as an injection in gonorrhœa. It may likewise be employed as a mild counter-irritant in bronchial and arthritic inflammations. In alopecia, when the scalp is covered and the glands occluded by a thickened and vitiated sebum, the oil of eucalyptus is of very material service. Its local stimulant effects sometimes prove valuable in anidrosis. A soap (sapo eucalyptoli) containing 5 per cent. of the oil is of utility in the treatment of foul wounds, or ulcers, and bromidrosis. In asthma, cigarettes may be smoked, containing leaves of eucalyptus, with belladonna or coca, and stramonium-leaves, associated with tobacco, if desired, and much advantage derived from it, especially if the fumes are inhaled. The fluid extract is an efficient stomachic in indigestion due to deficient secretion or to gastric or intestinal catarrh; by its use the intestinal tract becomes more healthy in character, and no longer affords a place of development for intestinal parasites. Eucalyptus is an efficient remedy in the vomiting caused by sarcinæ. In the ordinary oxyurides, or seat-worms, injections of a decoction of eucalyptus-leaves are useful, and this preparation may also be employed as a gargle for sore throat and stomatitis, scurvy, etc. The stimulating effect upon the circulation of the volatile oil, is well shown in cases of palpitation, irregularity, sudden flashes, and flatulence. As the drug is antiseptic, and escapes by the bronchial mucous membrane to a considerable degree, it is serviceable in chronic bronchitis, in the declining stage of pneumonia, in incipient phthisis, gangrene of the lungs, and diphtheria.

M. J. Roussel employs a mixture of eucalyptol and carbolic acid in some bland vegetable oil in the treatment of tuberculosis. He makes use of three different preparations, which respectively contain 10, 15, and 20 per cent. each of eucalyptol and carbolic acid. To the mixture he has given the name pheneucalyptol and uses it by injection. He claims good results, in phthisis, anthrax, epithelioma, and lupus. The injections are said to be practically painless.

In acute bronchitis or laryngo-tracheitis of children, Dr. S. Solis-Cohen prescribes:—

℞ Ammon. carbonat.	50 to	1	Gm.	or	gr. viii-xv.
Ammon. chlorid.	1 40 to	3	10 Gm.	or	gr. xxii-xlviij.
Fluidext. eucalypt.		6	c.cm.	or	f℥iss.
Syr. acaciæ,					
Syr. Tolutan.	aa	15	c.cm.	or	f℥ss.
Aquæ		60	c.cm.	or	f℥ij.

M. Sig.: A teaspoonful in milk or water every two or four hours for a child two years of age.

In subacute cases he adds a little paregoric to the above or a similar mixture.

When there is an anæmic state of the nerve-centres manifested by chorea, neurasthenia, hysteria, and asthma, benefit is derived from eucalyptol

given in capsules, emulsion, or simply dropped upon sugar (0.12 to 0.30 c.cm., or *m*ii-v, at a dose). In rheumatic or malarial headache it sometimes proves efficacious. The oil of eucalyptus affords decided relief to the headache which accompanies epidemic influenza, and is likewise efficacious in the neuralgia which may follow as a sequel, and in migraine. The elixir of eucalyptus (N. F.) is a good restorative. It represents gr. 7½ of eucalyptus in each drachm.

Eucalyptus is believed to be especially serviceable in catarrhal affections of the genito-urinary organs, desquamative nephritis, pyelonephritis, chronic catarrh of the bladder, with putrid urine, and in gleet. It likewise effects improvement in vaginitis. In fevers, especially malarial fevers, it is useful; but it is inferior to quinine in controlling the paroxysms, being mostly employed in chronic malarial poisoning and in convalescence from acute attacks, when it may be used in alternation with cinchona. This remedy causes reduction of the enlarged spleen, or "ague-cake," due to malarial toxæmia.

Dr. Benjamin Bell recommends tincture of eucalyptus to be given in 4-c.cm. (or f℥j) doses every third or fourth hour in typhoid fever, and believes that it exerts a favorable influence upon the diarrhœa. In scarlatina it is a good practice to add 5 drops of the oil of eucalyptus to 31 Gm. (or ℥j) of prepared lard, for use as an unguent to the general surface.

The red gum, or eucalyptus rostrata, is a pleasant astringent and is used in the form of the fluid extract as an application for tonsillitis and pharyngitis. Mr. Joseph W. England originated the following formula for a gargle, which is in use at the Philadelphia Hospital:—

Potassium chlorate	8	Gm. or gr. cxx.
Boiling water	120	c.cm. or f℥iv.
Powdered alum	4	Gm. or ℥j.
Stronger rose-water	78|50	c.cm. or f℥ii℥v.
Glycerin, Syrup aa	15	c.cm. or f℥iv.
Fluid extract of eucalyptus rostrata (red gum)	11	c.cm. or f℥iij.

Dissolve the potassium chlorate in the boiling water, cool, and reserve. Dissolve the alum in the stronger rose-water, add the glycerin, syrup, and fluid extract of red gum in the order named, and then add this to the reserved portion.

The product is a transparent ruby-red liquid, of a very agreeable odor and taste. To use, take a tablespoonful, add an equal volume of water, and gargle every three or four hours, or more often, if required.

It is a singular fact that fluid extract of red gum has not been received with more favor by the medical profession than it has. It possesses many advantages over other vegetable astringents; unlike sumach and catechu, its liquid preparations remain clear on dilution with water, and, what is more important, the astringency it exerts on mucous surfaces is peculiarly persistent. Stronger rose-water is double the strength of the usual rose-water, and gives, of course, a correspondingly stronger flavor of rose to the gargle. Possibly it might be of advantage, in some cases, to flavor the gargle with a few drops of oil of gaultheria in place of the rose-water.

Eucalypteol, or eucalyptene bichlorhydride, is a crystallized product derived from the essence of eucalyptus, by treating it with hydrochloric acid. Eucalypteol occurs in the form of white, micaceous scales, having a camphoraceous odor and a peculiar, faintly-bitter, persistent taste. This sub-

stance is soluble in ether, chloroform, fixed and volatile oils, petroleum ether, and acetic ether. It is almost insoluble in water and glycerin. In alkaline solutions and cold alcohol it is partially decomposed, a substance having the odor of terpinol being formed. According to the report of Dr. Lafage, eucalypteol is well borne by the stomach, is innocuous, and is decomposed in the intestine into hydrochloric acid and eucalyptol.

Eucalypteol is an efficient antiseptic, minute quantities preventing putrefaction, though it does not check the action of the digestive ferments. When taken by the mouth it is eliminated by the lungs, kidneys, and bowels. Eucalypteol is likewise eliminated in the saliva. When subcutaneously injected it is removed almost exclusively by the lungs.

Therapy. — Eucalypteol exerts a decided antiseptic action upon the bowel. It is appropriate to the treatment not only of diseases of the respiratory passages, but also to those involving the intestine, such as enteritis, diarrhœa, typhoid fever, fetid diarrhœa, the green diarrhœa of infants, etc.

In phthisis it allays the cough and other symptoms. It is preferably given in powders or capsules. The usual dose is 0.03 to 0.20 Gm. (or gr. ss-iij) or a total, daily, of 1.55 Gm. (or gr. xxiv) to adults.

EUGALLOL.—Pyrogallol Monacetate. (See **Pyrogallol.**)

EUGENOL (U. S. P.).—**Eugenol.** An unsaturated aromatic phenol obtained from the oil of cloves and other sources. It may be employed as a substitute for oil of cloves. (See **Oleum Caryophyllum.**)

EUONYMUS (U. S. P.).—**Euonymus (Wahoo).**

EUONYMI CORTEX (B. P.).—**Euonymus-bark.**

Preparations.

Fluidextractum Euonymi (U. S. P.).—Fluid Extract of Euonymus. Dose, 4 to 8 c.cm. (or f3i-ij).

Extractum Euonymi (U. S. P.).—Extract of Euonymus. Dose, 0.13 to 0.25 Gm. (or gr. ii-iv).

Extractum Euonymi Siccum (B. P.).—Dry Extract of Euonymus. Dose, 0.065 to 0.13 Gm. (or gr. i-ij).

Pharmacology.—"The dried bark of the root of Euonymus atropurpurea (Celastracæ)" contains a bitter, amorphous substance; also, resins, euonic acid, and aspargin. The impure resin, with the bitter principle, is known commercially as **Euonymin** (dose, 0.03 to 0.13 Gm., or gr. ss-ij). The principal constituents are **Euonymin** and **Euonic Acid.** It also contains a fixed and a volatile oil, resins, bitter extractive, etc. True euonymin is an amorphous, odorless, bitter principle, soluble in alcohol, and slightly in ether. It is probably a crystalline glucoside.

Physiological Action.—Euonymus is in small doses a tonic, increasing appetite and gastric secretions; in larger doses it is an irritant and cathartic. Euonymus is also an expectorant and diuretic, and exerts considerable influence upon the liver, as a cholagogue, resembling rhubarb in its action. The excretion of uric acid is at first increased, but subsequently diminished.

Therapy.—It has been employed as a cholagogic purgative, especially in conjunction with antiperiodic treatment, in malarial poisoning. In torpid liver and chronic constipation it aids the action of other remedies. Intestinal indigestion and jaundice are benefited by the administration of this

agent. As a diuretic, it has also been employed in cases of dropsy. Euonymin is a convenient form in which to prescribe it, although the solid extract is practically the same. It is claimed that it will cause the disappearance of albumin from the urine in acute Bright's disease. It also relieves a form of lumbago, which is more of a soreness and tenderness than actual pain. A preference is expressed for the preparations obtained from the green, fresh drug by the eclectic physicians, who esteem it highly.[1]

EUPATORIUM (U. S. P.).—**Eupatorium (Thoroughwort, Boneset).** **Dose,** 1 to 4 Gm. (or gr. xv-ʒj).

Preparation.

Fluidextractum Eupatorii (U. S. P.).—Fluid Extract of Eupatorium. Dose, 2 to 4 c.cm. (or *m*xxx-fʒj).

Pharmacology.—The dried leaves and flowering tops of Eupatorium perfoliatum (Compositæ), an indigenous plant, enjoy considerable reputation in recent infusion (boneset-tea) for acute colds, rheumatism, and dysmenorrhœa. They contain **Eupatorin,** a very bitter glucoside, with volatile oil, gum, and tannic acid. The root yields 5 per cent. of inulin.

Therapy.—The hot infusion (1 to 8) is a diaphoretic and (in large doses) emetic, acting like chamomile-flowers. The powdered dried herb is a domestic remedy for dyspepsia, but is best given in fluid extract.

The **Eupatorium purpureum,** gravel-root or trumpet-weed, an allied species, contains in its root an acrid resin and an oil, and is a stimulating diuretic. It is best given as a fluid extract of the root in dose of 2 to 7.5 c.cm. (or *m*xxx-fʒij). Crystals of **Euparin** sometimes deposit from the fluid extract: it is a yellow, neutral crystalline principle, distinct from, but resembling, quercitrin.

EUPHORBIA PILULIFERA.—Snake-weed. Euphorbia pilulifera (Euphorbiaceæ), pill-bearing spurge, is a native of most tropical countries. The variety which has been introduced into medical practice comes from Queensland, Australia. It is an annual herbaceous plant, growing to the height of one or two feet. The fresh root is red; the dry is reddish brown. The stalk is more or less procumbent and covered with yellowish hairs. The leaves are of a deep-green color. The fruit incloses three seeds, which bear some resemblance to a coffee-grain. The plant yields its virtues to water. The aqueous solution seems to contain tannin, but no alkaloid. The following are useful preparations of this agent: Decoctum euphorbiæ piluliferæ (decoction of euphorbia pilulifera); dose, 60 c.cm. (or fʒij). Extractum euphorbiæ piluliferæ (extract of euphorbia pilulifera); dose, 0.065 to 0.13 Gm. (or gr. i-ij). Tinctura euphorbiæ piluliferæ (tincture of euphorbia pilulifera); dose, 0.60 to 2 c.cm. (or *m*x-xxx). Extractum euphorbiæ piluliferæ fluidum (fluid extract of euphorbia pilulifera); dose, 2 to 4 c.cm. (or *m*xxx-fʒj).

Physiological Action.—A strong solution of this drug has no irritant effect upon the skin. The taste is slightly astringent. It causes no redness or smarting of the tongue or buccal cavity, but is irritant to the gastric

[1] *Journal of Medicine and Science,* May, 1898.

mucous membrane, and may occasion nausea or epigastric pain. No effect has been observed upon the spinal cord or muscular system. It produces no change in the calibre of the capillary vessels. The secretions are unaffected. Small doses are fatal to frogs and guinea-pigs, first accelerating and then retarding the respiration and circulation, probably acting directly upon their respective centres. It is thought to be eliminated by the liver, and is devoid of cumulative effects. The case has been recorded of a gardener who, after handling several species of euphorbia, was suddenly attacked by burning of the conjunctiva,—extending to the cheek, mouth, nose, and fauces,—increased lacrymation, sneezing, and constant desire to urinate. The manifestations were attributed to idiosyncrasy.

Therapy.—Euphorbia pilulifera is chiefly of value as a remedy in spasmodic asthma, though it is not without merit in other thoracic diseases. Dr. Marsset, to whom we owe our knowledge of its physiological action, employed it in a number of cases in private practice, and reports others from the service of Dujardin-Beaumetz. It was found of signal benefit in paroxysmal asthma, whether uncomplicated or connected with chronic bronchitis and emphysema. The effect was favorable and prompt, irrespective of the origin of the disorder. This remedy has also been used with good effect in the treatment of hay asthma. Dr. Tison has found the remedy beneficial in the dyspnœa of cardiac disease. In Australia the plant is highly esteemed for its power of allaying the asthmatic paroxysm. It has likewise been found of service in chronic bronchitis, especially when occurring in old people. Dr. Marshall has prescribed it with advantage in phthisis, in which it checked the cough, promoted expectoration, and exerted some anodyne influence. The decoction is slightly tonic. The leaves have also been smoked in a pipe with satisfactory results in cases of asthma. This remedy may be beneficially combined with potassium iodide in asthma associated with chronic bronchitis. A formula which has been recommended for asthma is as follows:—

℞ Ext. euphorb. pilulif.	2|	Gm.	or gr. xxx.
Nitroglycerin	|006	Gm.	or gr. $^1/_{10}$.
Sodii iodid., Potass. bromid. aa	1|30	Gm.	or gr. xx.
Tr. lobeliæ	1|20	c.cm.	or ♏xx.

M. et ft. pil. vel capsul. no. x.

Sig.: One, two, or three pills or capsules three times a day.

EUPHORBIUM.—The Euphorbia resinifera (Euphorbiaceæ) is a native of Morocco, the official portion being a gum-resin, which flows from incisions in the stem and hardens in the air. The substance is yellowish, opaque, or slightly translucent, and brittle; without odor, but the powder causes much irritation and sneezing; taste acrid and burning. It is insoluble in water, only partly soluble in alcohol. It consists of an acrid resin (38 per cent.), euphorbon (22 per cent.), gum (18 per cent.), malates (12 per cent.), etc.

Physiological Action.—It is irritating to the skin, and vesicant, owing to the acrid resin. **Euphorbon** is a drastic purgative and emetic.

Therapy.—It is employed only for external purposes as a rubefacient and counter-irritant. When combined with cantharides, it forms a good vesicating plaster (Janin's plaster).

The **Euphorbia corollata**, or large flowering spurge, is emetic, dia-

phoretic, and expectorant. The root is used (1 to 1.30 Gm., or gr. xv-xx), of which a decoction may be made.

EUPHORIN.—Phenylurethane. This compound, introduced by Professor Giacosa, of Turin, is an aniline product, occurring in the form of a white crystalline powder, sparingly soluble in cold water. It possesses a faint, aromatic odor, and a taste which, at first feeble, becomes warm and causing dilatation of peripheral blood-vessels.

Physiological Action.—Euphorin is antiseptic, antipyretic, and analgesic. It diminishes suppuration, and reduces abnormal temperature by causing dilatation of peripheral blood-vessels.

According to Dr. C. Curtis, its effect in depressing temperature manifests itself in from half an hour to two hours after administration, and may continue for as long a period as ten hours. It is said to occasion no serious secondary symptoms. In some instances cyanosis has been observed, but it does not seem to cause collapse. It likewise promotes diaphoresis. Euphorin is thought to increase the excretion of urea. When given by the mouth, it is not followed by the appearance of phenol, aniline, albumin, or sugar in the urine.

Therapy.—Euphorin in powder has been used with advantage upon ulcerated surfaces, and has been found capable of stimulating repair in chronic lesions. Peroni and Bovera report favorably of its efficacy as a local agent in various cutaneous manifestations of syphilis, having employed it in ninety-one cases in doses of 0.20 to 0.38 Gm. (or gr. iii-vj). Bergerio found it serviceable in ulcerative cervicitis. He employed it in the form of powder by insufflation and as a 1 to 3 alcoholic solution. Euphorin has been advantageously used in surgery as a substitute for iodoform. It is an efficient application in wounds, burns, scalds, bed-sores, herpes, and other cutaneous diseases, especially those of vegetable parasitic origin. In aphthous stomatitis it is equally of avail. Professor Stiller, of Pesth, administered euphorin in different forms of neuralgia, including hemicrania and sciatica, and, in most cases, observed relief of pain. He also found it beneficial in cases of chronic articular and muscular rheumatism, and rheumatic fever. By other observers it has been successfully employed in supra-orbital and intercostal neuralgia, syphilitic pains of the limbs, and orchitis. In acute rheumatism euphorin has sometimes been found more efficacious than the sodium salicylate.

EUPHRASIA.—Eyebright. The Euphrasia officinalis (Scrophulariaceæ), a small herb of the White Mountains and Lake-Superior region and also of Europe, with opposite leaves and spikes of blue flowers. In spite of its name it is not official in the United States Pharmacopœia. It is astringent, containing tannin, euphrastic acid, etc. A tincture (10 per cent.) is useful in incipient catarrhal affections, hay fever (dose, 0.60 c.cm., or *mx* every two hours), and measles.

EUPHTHALMIN HYDROCHLORIDE is a colorless crystalline substance derived from eucaine B. In aqueous solutions its action is that of a mydriatic and bears the same relation to eucaine that homatropine does to tropacocaine.

Dr. A. Darier, of Paris, reports that after his repeated use, covering

quite a period of time, he has yet to observe any of the unpleasant symptoms often met with after the use of the other well-known agents; to obtain full dilatation of the pupil he uses 1 or 2 drops of a 5-per-cent. solution. He also noticed that a rapid dilatation followed, while the power of accommodation was unaffected. Dr. Grandclément uses a solution containing 0.25 Gm. to 10 c.cm. (or gr. iv-*m*clx) of distilled water, while Dr. Edward Jackson prefers the combination of euphthalmin with cocaine to produce mydriasis.

EUROPHEN.—Isobutyl-ortho-cresol Iodide. Europhen is the product of the action of iodine upon isobutylorthocresol in a solution of potassium iodide. It occurs in the form of a fine, soft, amorphous powder, of a light-yellow color, without taste, and having a faint, not unpleasant odor. The odor almost entirely disappears when the substance is made into a mixture or solution. Europhen is insoluble in water or glycerin, but dissolves in alcohol, ether, chloroform, and fixed oils. The specific gravity of europhen is half that of iodol and one-fifth that of iodoform. Europhen is easily decomposed by light and heat, and should be kept in a dark, dry, and cool place, and its solutions be made at a low temperature. The average proportion of iodine contained in europhen is 27.6 per cent. Its solutions, upon standing, throw down a precipitate, consisting of an organic iodine compound, soluble in water. Europhen contains a very small percentage of free iodine. It is incompatible with starch, metallic oxides, and the salts of mercury.

Physiological Action.—Europhen adheres firmly to the skin, mucous membrane, and open surfaces. When taken into the system it undergoes little change. A very small proportion of iodine is found in the urine, and the greater portion passes through the intestinal canal unchanged. Europhen is non-toxic, but by a chemical action prevents the development of pathogenic micro-organisms in culture-media.

Therapy.—Europhen, in the form of a powder or 10-per-cent. ointment, is an excellent dressing to ulcers of various kinds. Leg-ulcers often heal rapidly under its influence. It forms a valuable application to wounds, chancroids, open buboes, ulcerated chancres, condylomata, and ulcerated lesions of secondary and tertiary syphilis. Dr. P. J. Eichhoff used it with advantage in scrofuloderma, lupus vulgaris, and deep burns, but found it of no avail in favus or gonorrhœa. He notes, however, that excellent results were obtained from europhen in the treatment of the erosions and ulcerations of the uterine neck of such frequent occurrence in association with gonorrhœa. The powder may be applied twice daily, or a tampon charged with europhen may be introduced.

The author has used[1] this substance with success in the treatment of incised, contused, and lacerated wounds. In chronic ulcers of the leg and scrofulodermata, also, it exerted a beneficial influence and led to rapid cicatrization of the lesions. A lupous ulcer was decidedly improved by the application of europhen, and eventually healed. In one case of superficial epithelioma an ointment containing 4 to 8 Gm. (or ʒi-ij) of europhen to 31 Gm. (or ʒj) effected a cure. In a second case, after europhen first, and subsequently aristol, had been used without much result, a mixture of equal

[1] "Europhen: with Clinical Reference to Europhen and Europhen-aristol." By John V. Shoemaker, A.M., M.D. See *Medical Bulletin*, Sept., 1892.

parts of europhen and aristol, made into an ointment, was applied with entire success. A 10-per-cent. ointment of europhen was efficient in sycosis, and the powder, dusted upon the surface of a carbuncle after the necrotic tissue had been removed, promoted the healing of the wound. Papular acne was cured by the application of an ointment containing from 4-8 Gm. to 31 Gm. (or ʒi-ii to ℥j) of base. In the second stage of rosacea a marked improvement followed the use of an alcoholic solution of europhen. The papules and pustules, together with the roughness of the skin, disappeared, and the capillary injection was diminished. An ointment was advantageous in erysipelas and in the dermatitis caused by poisoning by rhus toxicodendron. Applied as a dusting-powder, europhen proved beneficial in herpes progenitalis, herpes zoster, seborrhœa oleosa, hyperidrosis, and bromidrosis. An ointment was of assistance in the treatment of alopecia circumscripta. The powder was of value in several cases of acute vesicular eczema, while the ointment rendered good service in some severe cases of chronic eczema. The writer obtained a good result in one case of psoriasis from the use of an ointment containing the equal mixture of europhen and aristol. In syphilitic ulcers the experience of the writer is confirmatory to that of Eichhoff. From the clinic of Professor Jurasz, of Heidelberg, Dr. von Szoldrski reports a favorable influence in three cases of laryngeal tuberculosis with abundant secretion. He esteems europhen of value after operations upon the nose or larynx. Dr. Löwenstein has obtained good results with europhen in perforating ulcer of the nasal septum, and in epistaxis dependent upon erosion of the septum. Dr. Nolda employed europhen successfully in three cases of suppurative inflammation of the middle ear. Dr. Fernandez recommends europhen in cases of accidental or operative traumatisms of the eye, in conjunctivitis and keratitis. He generally employs a 1-per-cent. ointment. Europhen powder forms a convenient dressing, on account of its adhesive qualities and the fact that it does not harden into a compact cake upon the surface to which it is applied. Dr. K. J. Schumann, of Athens, Tenn., states that, in dental practice, europhen as a root-canal dressing cannot be surpassed. He makes a paste by combining europhen with a drop or two of carbolic acid. In pyorrhœa he cleanses the parts, applies protargol solution (20 per cent.), and fills pockets with europhen. Eichhoff has experimented with it hypodermically in the treatment of syphilis.

EXALGINE.—Methylacetanilide is a neutral derivative of the aromatic series, with the formula $C_6H_5N(CH_3)CH_3CO$, and is one of the three methyl derivatives of acetanilide. It is in fine, acicular, or long tablet-like crystals, the first being obtained by evaporation from solution, the latter from fusion. It is sparingly soluble in cold water, more so in hot water, and extremely soluble in diluted alcohol. Dose, 0.065 to 0.38 Gm. (or gr. i-vj), or from 0.38 to 0.75 Gm. (or gr. vi-xij) in the course of the day. Exalgine is devoid of odor or taste, and is of neutral reaction.

Physiological Action.—Exalgine has been brought forward by Brigonnet, of the Cochin Hospital, and has been extensively employed as an analgesic, its effect being principally manifested upon the sensory nerves. Exalgine, which is also an antiseptic, is eliminated by the urine, the amount of which it diminishes. It reduces abnormal temperature like other members of the group, and is claimed to be equally efficient in about half the dose of antipyrin. Broadbent has reported a case in which 0.25 Gm. (or gr. iv) doses

of exalgine had been ordered on account of neuralgia. The first dose relieved pain, but caused some dizziness. After the lapse of some hours, feeling a slight return of the pain, the patient took 0.75 Gm. (or gr. xij) at one dose. He immediately fell prostrate, was unconscious, and frothed at the mouth. The pulse was feeble and slow, the eyes closed, and pupils normal. Upon recovering consciousness he complained of noises in the head, was nauseated, and experienced pain in the hypogastrium. Evacuation of the stomach and stimulation were followed by recovery. In the case of a 2-year-old child, to whom 0.32 Gm. (or gr. v) of exalgine had been given in mistake, Dr. Reynery, of Havana, observed that the face and hands were of a dark-blue color, there was copious vomiting of mucus, with free perspiration, rapid and feeble pulse, prominence of veins of the neck, and pulsation of the carotids. The urine was dark gray and albuminous. There was diminution of sensibility in the lower limbs. The child was revived by the use of stimulants, and the symptoms gradually disappeared. As it is soluble in diluted alcohol, it may be given in water flavored with elixir of orange or rum. The smallness of the dose gives it a decided advantage over some other preparations of this group.

Therapy.—In all forms of neuralgia, especially the visceral forms, exalgine has been shown to have marked control over pain. It is said to decrease the quantity of sugar excreted in diabetes mellitus. In diabetes, from 0.38 to 0.75 Gm. (or gr. vi-xij) daily may be given. In facial neuralgia and myalgia, especially in anæmic, neurotic patients, good results are obtained from doses of 0.065 Gm. (or gr. j) every four hours. Löwenthal administered exalgine in thirty-five cases of chorea. It exerted no specific influence, but the severity of the manifestations was reduced. He concluded that the effect of the drug was much more favorable when its administration was begun early in the disease. Moncorvo recommends exalgine in the treatment of painful affections of children, to whom it is acceptable in taste and by whom it is well borne. He gives it in doses gradually ascending from 0.045 to 0.25 Gm. (or gr. $^3/_4$-iv), and considers it as equally efficacious as antipyrin in small doses. Visceral neuralgia, dysmenorrhœa, nephritic colic, and angina pectoris are relieved by the use of exalgine. The solubility of exalgine in water is promoted by the addition of an equal quantity of sodium salicylate: a combination which will often be of therapeutic efficiency.

EXODIN.—The trade name of diacetyl-rufi-gallic-acid-tetramethyl-ether. Is said to be tasteless, and does not excite nausea. It acts as a cathartic without griping or diarrhœa. Defecation occurs in 8 or 10 hours. It is supplied in tablets (0.50 Gm., or gr. viiss), two being the dose for an adult, one for a child.

FABIANA IMBRICATA.—Fabiana imbricata (Solanaceæ), or **Pichi**, a South-American plant, is a shrub, or small tree, which grows upon high, dry hill-tops. Its branchlets are arranged in the form of plume-like sprays, which have a peculiar, light-bluish-green color, due to the large amount of bluish or greenish-gray resin, with which all its tender parts are covered. Its principal constituents are a bitter ether-soluble alkaloid, **Fabianine**; a volatile oil containing **Fabianol**, a crystallizable resin. Besides these, the drug contains tannin, starch, and an abundant proportion of a glucoside analogous to esculin. The medicinal preparations are made from the dried leafy twigs.

Physiological Action.—A tincture of pichi has a disagreeable, persistent bitter taste, and, unless combined with an alkali, its resin is precipitated upon the addition of water. Pichi exerts a stimulant effect upon the kidneys, but its physiological action has not been closely studied. Administration of the resin-acid to frogs caused narcosis, followed by paralysis and death. The fluid extract, when given to human subjects in medicinal doses, has no disturbing effect upon the stomach, but, on the contrary, improves the appetite. The essential oil of pichi acts as a stimulant to secreting organs generally, and modifies or cures chronic purulent discharges from mucous membranes.

Therapy.—Its therapeutic influence is chiefly manifested in affections of the genito-urinary apparatus. In enuresis nocturna pichi has often a most beneficial action. The following combination will be found useful:—

℞ Fluidextractum fabianæ ..... 4| c.cm. or f3j.
Tinct. belladonnæ foliorum ..... |75 c.cm. or *m*xij.
Aquæ cinnamomi ..... 90| c.cm. or f3iij.
M. Sig.: A teaspoonful morning and night for a child.

It has also been efficaciously employed in gonorrhœa, especially during the inflammatory stage. Pichi is beneficial in epididymitis and prostatitis, and has been given with success in jaundice and dyspepsia dependent upon an insufficient secretion of bile. The oil is of service in the treatment of bronchial and intestinal catarrh. It is of value in lithiasis, or calculus of the kidney or bladder. In chronic renal congestion and calculous pyelitis this drug is of service, except when degeneration of renal tissues exists. Dr. Hal. C. Wyman reports very favorably upon this remedy in cystitis dependent on stricture or manipulative procedures within the urethra, and likewise in cases of lumbago and sciatica associated with the deposition of uric acid. As a diuretic in cases of gravel and calculi the following combination will often prove of service:—

℞ Fluidextractum fabinæ ..... 60| c.cm. or f3ij.
Liq. potass. ..... 18|5 c.cm. or f3v.
Tr. nucis vom. ..... 7|5 c.cm. or f3ij.
Elix. calisayæ .....q. s. ad 120| c.cm. or f3iv.
M. Sig.: Teaspoonful in hot water every four or five hours.

Pichi is likewise of service in prostatic inflammation or hypertrophy, and is valuable in gonorrhœa attended by complications in which it is necessary to suspend the use of local methods.

FARINA TRITICI (B. P.).—**Wheaten Flour.** The grain of wheat, Triticum sativum (Graminea), ground and sifted.

FEL BOVIS (U. S. P.).—**Ox-gall.**

Preparations.

Fel Bovis Purificatum (U. S. P.).—Purified Ox-gall (pilular consistence). Fel Bovinum Purificatum (B. P.).—Purified Ox-bile. Dose, 0.32 to 1 Gm. (or gr. v-xv).

Pharmacology. — Fresh bile of Bos taurus (class, Mammalia; order, Ruminantia) is a greenish-brown, viscid liquid, with a peculiar, nauseating

odor and bitter, offensive taste. Its solution froths when shaken and saponifies fat. Its reaction is alkaline; specific gravity, 1018 to 1028.

Physiological Action and Therapy.—Ox-gall is antiseptic and laxative, assisting in the absorption and digestion of fats in the intestinal tract and stimulating peristalsis. The local application of bile causes absorption of hypertrophies, and enlarged tonsils. It may be used internally to assist the digestion and assimilation of fatty foods or of codliver-oil, and may be given in habitual constipation with deficient assimilation. Ox-gall has likewise been used for the purpose of expelling lumbricoid worms.

In jaundice, Harley recommends the use of ox-gall, given in capsules, in order that it may reach the duodenum without being acted on by the stomach. It is also of benefit in hepatic and intestinal affections.

℞ Fellis bovis purificati,
Magnesii carbonatis ..... aa 6 | 50 Gm. or gr. c.
Ol. menth. pip. ..... | 06 c.cm. or *m*j.
M. et ft. capsulæ no. xx.
Sig.: A capsule three or four times a day, after meals, in dyspepsia and constipation.

℞ Fellis bovis purificati..... 4 | Gm. or 3j.
Extracti nucis vomicæ,
Aloini ..... aa | 065 Gm. or gr. j.
Ol. cinnamomi ..... | 06 c.cm. or *m*j.
M. et ft. pil. no. xx.
Sig.: Two pills between meals. Serviceable in torpor of the liver and in dyspepsia.

FERMENTUM.—Yeast.

Yeast is the ferment obtained in brewing beer, and is produced by Saccharomyces cerevisiæ. According to Schlossberger, its composition is carbon, 49.9 per cent.; hydrogen, 6.6 per cent.; nitrogen, 12.1 per cent.; and oxygen, 31.4 per cent. It contains, as proximate constituents, cellulose, albuminoids, fats, and resinous substances.

Pharmacology.—Yeast is a pale-brown, viscid, frothy liquid, with a bitter taste. Used externally in a poultice for boils and suppurating wounds or foul ulcers, and internally as an alterative tonic in furuncles and typhoid fever. Dr. M. B. Thompson has reported thirty-seven cases in which yeast was used in the treatment of typhoid, in all of which recovery took place without relapse. It is said to cause disappearance of sugar from the urine in diabetes. Dose, 15 to 30 c.cm. (or f℥ss-j) before meals. Roos[1] has used yeast (dried at 86° F.) in powder in doses of 0.50 Gm. (or gr. viij) two or three times a day in the treatment of constipation. He reports twenty cases; sixteen were so benefited that their evacuations were easy and copious, and in most of them the appetite was increased. *Cerevisine*, a proprietary article, is a pure desiccated yeast, and has been used with success in the treatment of psoriasis, herpes, and some varieties of eczema in doses of 1 teaspoonful three times a day.

FERRUM.—Iron. Metallic iron in the form of fine, bright, and non-elastic wire (U. S. P.). Wrought iron in the form of wire or nails free from oxide (B. P.).

[1] *N. Y. Med. Jour.*; *Med. Bull.*, May, 1901.

U. S. P. Preparations.

Elixir Ferri, Quininæ, et Strychninæ Phosphatum (U. S. P.).—Elixir of Phosphates of Iron, Quinine, and Strychnine. Dose, 4 c.cm. (or 3j) (containing strychnine phosphate, gr. $^1/_{64}$).

Glyceritum Ferri, Quininæ, et Strychninæ Phosphatum).—Average dose, 1 c.cm. (or *m*xv) (containing gr. $^1/_{100}$ of strychnine).

Ferri Carbonas Saccharatus.—Saccharated Ferrous Carbonate. Dose, 0.13 to 0.65 Gm. (or gr. ii-x).

Ferri Chloridum.—Ferric Chloride. Used as hæmostatic and pharmaceutically.

Ferri Citras.—Ferric Citrate. Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Ferri Hypophosphis.—Ferric Hypophosphite. Dose, 0.32 to 0.65 Gm. (or gr. v-x).

Ferri Phosphas Solubilis.—Soluble Ferric Phosphate. Dose, 0.32 to 0.65 Gm. (or gr. v-x).

Ferri Pyrophosphas Solubilis.—Soluble Ferric Pyrophosphate. Dose, 0.13 to 0.32 Gm. (or gr. ii-v).

Ferri Sulphas.—Ferrous Sulphate. Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Ferri Sulphas Exsiccatus.—Dried Ferrous Sulphate. Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Ferri Sulphas Granulatus.—Granulated Ferrous Sulphate. Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Ferri et Ammonii Citras.—Iron and Ammonium Citrate. Dose, 0.20 to 0.32 Gm. (or gr. iii-v). (Should always be given in solution.)

Ferri et Ammonii Sulphas.—Ferric Ammonium Sulphate (Ammonio-ferric Alum). Dose, 0.20 to 0.32 Gm. (or gr. iii-v).

Ferri et Ammonii Tartras.—Iron and Ammonium Tartrate (Ammonio-ferric Tartrate; about 25 per cent. ferric oxide). Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Ferri et Potassii Tartras.—Iron and Potassium Tartrate (Potassio-ferric Tartrate). Dose, 0.32 to 1 Gm. (or gr. v-xv).

Ferri et Quininæ Citras.—Iron and Quinine Citrate (ferric citrate, 85; quinine, 12; citric acid, 3 parts). Dose, 0.20 to 0.32 Gm. (or gr. iii-v). (Suitable for pills.)

Ferri et Quininæ Citras Solubilis.—Soluble Iron and Quinine Citrate. Dose 0.20 to 0.65 Gm. (or gr. iii-x). (Best prescribed in solution.)

Ferri et Strychninæ Citras.—Iron and Strychnine Citrate (98 Gm. iron and ammonium citrate; 1 Gm. each of strychnine and citric acid). Dose, 0.065 to 0.20 Gm. (or gr. i-iij).

Ferri Hydroxidum.—Ferric Hydroxide. (Hydrated Oxide of Iron freshly precipitated by the addition of an excess of ammonia to the solution of the ferric sulphate and washed and strained. For use as an antidote to arsenous-acid poisoning, 20 grains to be taken for each grain of arsenic swallowed, a tablespoonful the ordinary dose as an antidote.)

Ferri Hydroxidum Hydratum cum Magnesii Oxido.—Ferric Hydroxide with Magnesium Oxide. (Solution of ferric sulphate, 50 c.cm., or f3xiiiss; magnesia, 10 Gm., or 3iiss.) The solution of ferric sulphate is to be diluted with 100 c.cm., or f3xxvij, of water and kept in a large, well-stoppered bottle until needed for use. The magnesia should be kept in a bottle filled about three-fourths with water. When required for use the magnesia is to be shaken into a homogenous thin magma and the iron solution gradually added, and shaken together until a uniform smooth mixture results. Antidote to arsenic.

Ferrum Reductum.—Reduced Iron. Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Liquor Ferri Chloridi.—Solution of Ferric Chloride (29 of ferric chloride). Principally used in making the tincture. Dose, 0.12 to 0.60 c.cm. (or *m*ii-x).

Liquor Ferri et Ammonii Acetatis.—Solution of Iron and Ammonium Acetate (Basham's Mixture) (contains tincture of ferric chloride, 40 c.cm.; diluted acetic acid, 60 c.cm.; solution of ammonium acetate, 500 c.cm.; aromatic elixir, 120 c.cm.; glycerin, 120 c.cm.; water, a sufficient quantity to make 1000 c.cm). Should be freshly made when wanted. (This preparation is about twice as strong as that of 1890 Pharmacopœia.) Dose, 2 to 8 c.cm. (or f3ss-ij).

Liquor Ferri Subsulphatis.—Solution of Ferric Subsulphate (Monsel's Solution). Dose, 0.12 to 0.60 c.cm. (or *m*ii-x).

Liquor Ferri Tersulphatis.—Solution of Ferric Sulphate (for making hydrated oxide of iron).

Massa Ferri Carbonatis.—Mass Ferrous Carbonate, Vallet's Mass (ferrous sul-

phate, 100; sodium carbonate, 38; honey, 38; sugar, 25; syrup and water, q. s. ad 100 parts), has 42 per cent. ferrous carbonate. Dose, 0.20 to 0.32 Gm. (or gr. iii-v).

Mistura Ferri Composita.—Compound Iron Mixture. Griffith's Mixture (ferrous sulphate, 6; myrrh, 18; sugar, 18; potassium carbonate, 8; spirit of lavender, 60; rose-water, q. s. ad 1000 parts). Dose, 30 to 60 c.cm. (or f℥i-ij).

Pilulæ Aloes et Ferri.—Pills of Aloes and Iron (aloes, iron sulphate, aromatic powder). Dose, 1 to 3 pills.

Pilulæ Ferri Carbonatis.—Pills of Ferrous Carbonate (Blaud's Pills).—Iron Pill. Dose, 2 to 5 pills.

Pilulæ Ferri Iodidi.—Pills of Ferrous Iodide. Dose, 2 to 4 pills.

Syrupus Ferri Iodidi.—Syrup of Ferrous Iodide (5 per cent ferrous iodide). Dose, 0.30 to 2 c.cm. (or *m*v-xxx).

Syrupus Ferri, Quininæ, et Strychninæ Phosphatum.—Syrup of the Phosphates of Iron, Quinine, and Strychnine contains about 0.07 Gm. (gr. $1^1/_4$) of iron; 0.10 Gm. (or gr. iss of quinine, and 0.00082 Gm. (or gr. $^1/_{85}$) of strychnine to 4 c.cm. (or f℥j). Dose, 2 to 4 c.cm. (or f℥ss-j).

Syrupus Hypophosphitum.—Syrup of Hypophosphites (ferrous lactate, 1 per cent.). Dose, 4 to 15 c.cm. (or f℥i-iv).

Syrupus Hypophosphitum Compositus.—Compound Syrup of Hypophosphites.

Tinctura Ferri Chloridi.—Tincture of Ferric Chloride (13.28 per cent. of ferric chloride; solution of ferric chloride, 35; alcohol, q. s. ad 100 parts). Dose, 0.30 to 1.30 c.cm. (or *m*v-xx).

Vinum Ferri Amarum.—Bitter Wine of Iron. Dose, 4 to 15 c.cm. (or f℥i-iv).

Vinum Ferri.—Wine of Ferric Citrate (contains iron and ammonium citrate, 4 parts; tincture of sweet orange-peel; syrup, and white wine). Dose, 4 to 15 c.cm. (or f℥i-iv).

B. P. Preparations.

Ferri Arsenas.—Iron Arsenate. Dose, 0.004 to 0.015 Gm. (or gr. $^1/_{16}$-$^1/_4$).

Ferri Carbonas Saccharatus.—Saccharated Iron Carbonate. Dose, 0.65 (or gr.x).

Ferri et Ammonii Citras.—Iron and Ammonium Citrate. (Should always be given in solution.) Dose, 0.13 to 0.32 Gm. (or gr ii-v).

Ferri Phosphas.—Iron Phosphate. Dose, 0.32 to 0.65 Gm. (or gr. v-x).

Ferri Sulphas.—Ferrous Sulphate. Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Ferri Sulphas Exsiccatus.—Exsiccated Ferrous Sulphate. Dose, 0.03 to 0.20 Gm. (or gr. ss-iij).

Ferri et Quininæ Citras.—Iron and Quinine Citrate. Dose, 0.32 to 0.65 Gm. (or gr. v-x).

Ferrum Redactum.—Reduced Iron. Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Ferrum Tartaratum.—Tartarated Iron. Dose, 0.32 to 0.65 Gm. (or gr. v-x).

Liquor Ferri Acetatis.—Solution of Ferric Acetate. Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Liquor Ferri Perchloridi.—Solution of Ferric Chloride. Dose, 0.30 to 1 c.cm. (or *m*v-xv). Compound of one part strong solution and three parts of distilled water.

Liquor Ferri Perchloridi Fortis.—Strong Solution of Ferric Chloride (100 c.cm., or f℥xxvij, contain 22.5 Gm., or 3v $^7/_8$, of iron).

Liquor Ferri Pernitratis.—Solution of Ferric Nitrate. Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Liquor Ferri Persulphatis.—Solution of Ferric Sulphate.

Mistura Ferri Composita.—Compound Mixture of Iron (ferrous sulphate, 2.5 Gm.; potassium carbonate, 3 Gm.; myrrh. 6 Gm.; sugar, 6 Gm.; spirit of nutmeg, 4.5 c.cm; rose-water, 437.5 c.cm.). Dose, 30 to 60 c.cm. (or ℥i-ij).

Pilula Ferri.—Iron Pill. Dose, 0.32 to 1 Gm. (or gr. v-xv).

Pilula Aloes et Ferri.—Pill of Aloes and Iron. Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Syrupus Ferri Iodidi.—Syrup of Ferrous Iodide. Dose, 0.30 to 2 c.cm. (or *m*v-xxx).

Syrupus Ferri Phosphatis.—Syrup of Ferrous Phosphate. Dose, 2 to 4 c.cm. (or f℥ss-j).

Syrupus Ferri Phosphatis cum Quinina et Strychnina.—Syrup of Phosphate of Iron, Quinine, and Strychnine. Dose, 2 to 4 c.cm. (or f℥ss-j).

Tinctura Ferri Perchloridi.—Tincture of Ferric Chloride (strong solution of ferric chloride, 25 c.cm.; alcohol, 90 per cent., 25 c.cm.; distilled water, q. s. 100 c.cm.). Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Trochiscus Ferri Redacti.—Reduced-Iron Lozenge (contains reduced iron, 0.065 Gm., or gr. j, with a simple basis).

Vinum Ferri.—Iron-wine (iron, 50 Gm., or 3xiij; sherry-wine, 1000 c.cm., or f℥xxxiv). Dose, 4 to 15 c.cm. (or f3i-iv).

Vinum Ferri Citratis.—Wine of Iron Citrate (iron and ammonium citrate, 160 grs.; orange-wine, 20 fluid ounces). Dose, 4 to 15 c.cm. (or f3i-iv).

Pharmacology. — Iron is a metallic element, the most abundant, the most widely distributed and most useful to mankind of all the metals. In its pure state it is malleable and ductile, and the pharmacopœia directs its use, therefore, in the pure form of "fine, bright, non-elastic wire," out of which preparations should be made. Ferric salts in solution or in crystals are generally red, and the ferrous salts green; they are likely to be decolorized by drying and become white. The iron compounds are also known as chalybeates, or martial preparations; a large number are used in medicine, besides those found as constituents in natural water. The chemical tests—vegetable astringents containing tannic or gallic acid, alkalies and their carbonates, acidulous salts and mucilage of acacia—are incompatible with iron preparations.

Physiological Action.—As one of the proximate principles of the human organism, and playing an important part in the red blood-corpuscle (as hæmoglobin) in the nutrition of the body, iron is a necessary element in the food. When applied to the tissues, most of the salts of iron exercise an astringent effect, producing coagulation of albumin. Some of the preparations, notably the solution of the subsulphate and the chloride, are very useful in coagulating blood and checking hæmorrhage, when locally applied. A similar astringent effect is observed in the mouth and along the alimentary canal. One of the objections to the use of most of the iron salts in medicine is the fact that they cause constipation and headache. The phosphate and pyrophosphate are exceptions to this, being non-constipating. Only a small proportion of the iron administered is assimilated, the larger proportion being discharged with the fæces, to which a black color, due to the formation of the sulphide, is imparted. The portion absorbed is largely thrown out again in the bile.

Iron augments the amounts of urea and increases the frequency of micturition, the tincture of the chloride especially being credited with diuretic properties. It has a tonic influence upon the nerve-centres, but improves nutrition principally by its effect upon the circulation. While iron has little power of increasing the number of blood-corpuscles in health, this power is shown very decidedly in conditions of anæmia or hydræmia, the number of globules being rapidly increased and the hæmoglobin of the blood gradually brought up to the healthy standard. The absorption of iron preparations by the alimentary canal is accepted, by Binz, but he looks on them rather as stimulating the blood-forming organs than as contributing directly to the production of hæmoglobin. Ilyasheff[1] found that salts of the heavy metals, copper, mercury, and manganese, administered in small amounts by the mouth, have no appreciable influence on the amount of hæmoglobin or on the number of the reds. Salts of iron, however, under the same conditions always have a marked effect in increasing the number of reds and the amount of hæmoglobin. It is evident that iron not only stimulates the func-

[1] *Vratch*, St. Petersburg, November 2, 1901.

tions of the blood-producing organs, but directly aids in the production of hæmoglobin. The influence of the iron is first manifested in the increased number of red corpuscles; the increase in the hæmoglobin is a later phenomenon. The eosinophile cells also increase to a remarkable proportion under the influence of iron. This is not observed in animals nor in other conditions in man. The eosin granules contain iron and apparently in a stable organic combination, as they give the iron reaction with ammonium sulphate only after twelve to twenty-four hours. It is supposed that the iron present in the blood-corpuscles has the property of converting oxygen into ozone, and that it thus promotes oxidation. The heart is also toned up by the effects of the iron preparations, probably owing largely to the stimulus of a better blood-supply to its walls. The stomach is stimulated by the astringent action of the iron, and the appetite and digestive capacity are improved under small doses not too long continued.

As confirmatory of this view, A. Hoffmann, of Halle,[2] has found that absorption and excretion of iron takes place in the small intestine in man, and, also in animals, in the colon. In recent observations he determined the fact that all forms of iron were absorbed in the duodenum and entered the circulation in transport-cells combined with albuminous matter in a combination which had no toxic action. There was no apparent increase in the coloring matter of the blood from the use of iron. In fact, iron has a stimulating action on the physiological activity of the bone-marrow, and accelerates the ripening and entrance into the circulation of the young cells: the anuclear erythrocytes. The action of the iron depends directly upon the quantity absorbed. Iron slightly raises the temperature of the body partly by increasing tissue-waste, partly by its ozonizing effects. Some of the stronger preparations—sulphates, nitrate, iodide, and chloride—are irritant, and, in large doses, poisonous. An acneic eruption sometimes results from the internal administration of iron.

Therapy.—The styptic qualities of iron are best shown by Monsel's solution and the chloride, in powder or solution, when applied directly to the oozing surface, as in surgical operations, post-partum hæmorrhage, hæmorrhage from the uterus after miscarriage, or cancer of that organ.

The resulting clot is very tough and dark colored, and makes a dirty, disagreeable mass, so that, in ordinary surgical practice, iron is rarely used as an hæmostatic, when a substitute can be found. In some forms of uterine hæmorrhage Monsel's solution may be used, diluted (1 to 24) or applied in full strength, upon a small swab to the inner surface of the uterus, if the os has been previously dilated; or the vagina may be temporarily packed with tampons of absorbent cotton wet with a 5-per-cent. solution.

In epistaxis, or hæmoptysis, a spray of 1- or 2-per-cent. strength of Monsel's solution may be inhaled. Excessive hæmorrhage from leech-bites or after the extraction of teeth may be controlled by the direct application of the same agent. A solution of the subsulphate may be successfully used to restrain bleeding from hæmorrhoids. The same preparation is effective in destroying syphilitic vegetations. Fissured nipples may be cured by painting them with a mixture of 1 part of Monsel's solution to 3 or 4 of glycerin. A spray of the subsulphate is beneficial in chronic ozæna. In erysipelas the tincture is an excellent local application. The astringent preparations of

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[1] *Münchener mediscinische Wochenschrift*, 1899, No. 29.

iron may be used with good effect as injections in gonorrhœa and gleet. Two c.cm. (or f℥ss) of the tincture to $^1/_2$ pint of water, with 4 c.cm. (or f℥j) of laudanum or 0.75 Gm. (or gr. xij) of the sulphate to the same quantity of water and laudanum, are forms in which iron may be used for this purpose. These solutions of iron, however, are open to the objection that they stain the patient's clothing. A liquid containing an astringent salt of iron is also a serviceable wash in leucorrhœa. In tonsillitis, pharyngitis, and diphtheria the same agent may be applied directly to the throat, either pure or diluted with an equal quantity of glycerin; this application is sometimes painful, but is very efficient. The tincture of ferric chloride, though less astringent than Monsel's solution, may be used locally in the same way. In diphtheria it can be administered internally in this form, and if, as is usually done, the preparation is suitably diluted with water, and then taken through a glass tube (so as to prevent the iron from staining and corroding the teeth), the solution will come directly in contact with the pharynx as it is swallowed, and thus combine the local and systemic effects. In such cases it is sometimes prescribed in combination, as follows:—

℞ Tincturæ ferri chloridi	30	c.cm. or f℥j.
Potassii chloratis	4	Gm. or ℥j.
Syr. aurantii	60	c.cm. or f℥ij.

M. Sig.: Half a teaspoonful to a teaspoonful every two hours, in water, in diphtheria or erysipelas.

These styptic preparations have also been injected into nævi and vascular tumors, to produce coagulation of their contents, but death has resulted from the escape of some of the fluid into the general circulation.

The tincture of iron is a beneficial local application in certain affections of the skin. It will in some instances relieve paræsthesia and the itching which accompanies eczema. The conjoined internal and external use of this preparation is frequently of advantage in chronic disorders attended by suppuration, as pustular eczema, impetigo, ecthyma, and rupia. A combination of tincture of iron and glycerin has been serviceably applied in herpes.

The principal employment of the iron preparations is for their effect upon hæmatosis. They are pre-eminently useful in cases of anæmia, hydræmia, or chlorosis, and in many cases of debility. The well-known Basham's mixture, or solution of iron and ammonium acetate (U. S. P.), is very commonly given to overcome the anæmia of chronic Bright's disease of the kidney. Dr. James Tyson has called attention to the fact, however, that, as regards the degenerative and inflammatory conditions in the kidneys, it is not always beneficial and, in fact, is often very injurious.[1] Dr. Tyson says that it should not be given in any case of acute Bright's disease, nor where there is not anæmia. If it causes headache, constipation, and reduces excretion by the kidneys, it is doing harm.

Dr. Andrew Smart, of Edinburgh, has found, by means of the apparatus employed for estimating the number of corpuscles contained in a specimen of blood, that the sulphate is the most valuable preparation of iron in the treatment of anæmia and chlorosis. The carbonate comes next in order of efficiency, and the syrup of the protochloride occupies the third place upon the list. A combination with arsenic increases the efficacy of the sulphate.

[1] *Journal of the American Medical Association*, July 23, 1898, p. 172.

The preparations of iron should not be used in plethora. As they all, to a greater or less degree, interfere with the digestive function, checking the secretions along the alimentary tract, and frequently constipate, the state of the stomach should always be considered when prescribing iron. Where the tongue is red and dry, as Fothergill has shown, iron always disagrees, and should not be ordered. On the other hand, a pale, broad, and flabby tongue, marked by the impression of the teeth, is especially indicative of the demand of the system for iron. There are great differences in this respect, however, between the several preparations of iron, and new chalybeates are being constantly brought forward with the recommendation that they do not derange the digestion nor produce constipation.

One of the most efficacious of the ferruginous preparations is the tincture of the chloride, but, in addition to its disturbing effect upon the digestion, it is open to the objection that it stains and corrodes the enamel of the teeth. This action is due to the presence of free hydrochloric acid. It is customary to direct patients to largely dilute the liquid, to imbibe it through a tube, and to clean the teeth, immediately after taking the medicine, with a weak alkaline solution. The virtues, without the disadvantages, of the tincture of iron seem to be possessed by a preparation devised by Dr. George W. Weld, of New York. This syrup of the chloride consists of the official tincture with the excess of acid neutralized and a certain amount of the syrup of gaultheria added for the sake of palatability. Each fluidounce contains 24 minims of the tincture. It is said not to injure the enamel and not to derange the digestion.

In amenorrhœa, Blaud's pills of carbonate of iron are of great service, or the compound mixture may be used with excellent effect. Iron is of most value in simple anæmia, such as that following hæmorrhage; it is of less service where the anæmia is symptomatic and accompanies organic diseases or blood poisoning. In such cases it acts more quickly when given hypodermically, the ammoniocitrate dissolved in distilled water being preferred.

This salt has been successfully employed in the same manner for the relief of subacute or chronic eczema, associated with or dependent upon anæmia.

Da Costa extolled the citrate of iron and manganese, administered hypodermically, in anæmia. Professor Rummo injects every day, into the interscapular region, half a syringeful of a 1 to 10 solution of iron and ammonium citrate in distilled water. No inflammatory action is excited.

Dori has applied this method with success to chlorosis. As a result of a comparative study he states that the most satisfactory and rapid results were obtained from the injection of iron and ammonium citrate. The usual daily dose administered was about 0.065 Gm. (or gr. j).

In advocating the subcutaneous injection of iron in anæmia, Dr. Enrico Magagni contends that when introduced by the mouth it is borne by the portal system to the liver, which alone it directly influences, while upon the hæmatopoietic organs it can only exert an indirect and altogether feebler effect. When thrown under the skin it is able to act directly upon the whole blood-forming apparatus. A larger actual dose is, by this method, absorbed than when it is given by way of the mouth. In consequence of the more rapid absorption a more rapid effect is obtained. As the most convenient place for injection Magagni recommends the nates, where the pain is almost imperceptible.

The anæmia which results from chronic malaria is very amenable to the influence of iron. The enlarged spleen of malaria diminishes in size and malarial neuralgia is relieved. Iron is of constant service in the treatment of neuralgia, which so often depends upon a condition of anæmia:—

℞ Mass. ferri carbonatis	1	55	Gm. or gr. xxiv.
Extracti hyoscyami		32	Gm. or gr. v.
Podophyllotoxin.		065	Gm. or gr. j.
Quininæ sulphatis		75	Gm. or gr. xij.

M. et ft. pil. no. xij.
Sig.: From four to six pills a day, for neuralgia.

℞ Ferri et quininæ citratis solubilis	7	5	Gm. or 3ij.
Liquor potassii arsenitis	7	5	c.cm. or f3ij.
Elix. guaranæ	q. s. ad 90		c.cm. or f3iij.

M. Sig.: A teaspoonful three or four times a day. Use in malaria and neuralgia.

Improvement takes place in pseudoleukæmia, or Hodgkin's disease, when iron is administered, especially in conjunction with arsenic, though the chalybeate preparations are of no utility in true leukæmia:—

℞ Ferri pyrophosphatis	2	60	Gm. or gr. xl.
Arseni trioxidi		065	Gm. or gr. j.
Extracti nucis vomicæ		20	Gm. or gr. iij.
Extracti belladonnæ folior		13	Gm. or gr. ij.

M. et ft. pil. no. xx.
Sig.: A pill three times a day.

The tincture of iron is, at times, beneficial in acute rheumatism. It is in the case of weak and pale individuals that iron is likely to be of service. In such subjects the same remedy is capable of acting, to a certain extent, as a prophylactic. It is frequently judicious in syphilis, when accompanied by evidence of profound deterioration of general nutrition, to suspend specific remedies temporarily, and place the patient upon a tonic course containing iron, which may be favorably combined with quinine, strychnine, or ignatia.

An efficient mixture made use of in the Skin Clinic of the Post-graduate School of New York is thus composed:—

℞ Ferri et ammon. citrat.	4		Gm. or 3j.
Hydrarg. chlor. corr.		065	Gm. or gr. j.
Potass. iodidi	8		Gm. or 3ij.
Vini ferri dulcis (Malaga)	q. s. ad 90		c.cm. or f3iij.

M. Sig.: Teaspoonful in water after meals.

In the so-called gonorrhœal rheumatism iron will generally be found advantageous. Hecquet for nearly twenty years has used ferrous bromide in nervous affections, and Da Costa found it useful in chorea. This salt has also been recommended as of service in leucorrhœa, diabetes, and tuberculosis.

Anæmic epileptics are benefited by iron, which may be very appropriately given in the form of the bromide and combined with potassium bromide, as:—

℞ Potassii bromidi ..... 23|3 Gm. or 3vj.
Syrupi ferri bromidi ..... 22| c.cm. or f3vj.
Tincturæ chiratæ,
Elixir aromatici..... aa 30| c.cm. or f℥j.
Aquæ cinnamomi .....q. s. ad 180| c.cm. or f℥vj.

M. Dose: A tablespoonful three times a day.

Dr. Rosenthal advises subcutaneous injections of iron in nervous disorders. He prefers either the ferrum peptonatum, a syringeful of a 1 to 10 aqueous solution being given every second day, or ferrum oleatum, diluted to 1 to 20 by olive-oil and used in the same manner. Ferrum peptonatum has the advantage of greater solubility and stability. It is obtained by the decomposition of ferric-chloride solution with solution of pepsin and occurs as a brownish-yellow powder.

The following combinations containing iron may be employed with good effect in gonorrhœa and syphilis:—

℞ Pilulæ ferri iodidi..... 4| Gm. or 3j.
Extracti ignatiæ,
Extracti belladonnæ folior..... aa |13 Gm. or gr. ij.

M. et ft. pil. no. xxx.
Sig.: From four to six pills a day in gonorrhœal rheumatism and in gleet.

℞ Ferri phosphatis,
Salolis ..... aa 10| Gm. or gr. cl.
Terebenæ ..... 7|5 c.cm. or f3ij.

M. et ft. capsulæ no. xxx.
Sig.: Three to six capsules a day in gonorrhœa, gonorrhœal rheumatism, and cystitis.

℞ Ferri et potassii tartratis ..... 8| Gm. or 3ij.
Arsenii trioxide..... |065 Gm. or gr. j.
Extracti cocæ ..... 4| Gm. or 3j.

M. et ft. pil. no. xl.
Sig.: Two pills three times a day in syphilis.

℞ Liquor ferri malatis,
Aquæ cinnamomi,
Glycerini ..... aa 30| c.cm. or f℥j.

M. Sig.: One to two teaspoonfuls in water three times a day for syphilis with irritable stomach.

℞ Ferri lactatis ..... 2|60 Gm. or gr. xl.
Extracti cannabis Indicæ ..... |10 Gm. or gr. iss.
Extracti rhamni purshianæ ..... |20 Gm. or gr. iij.

M. et ft. pil. no. xij.
Sig.: A pill three or four times a day in syphilis.

℞ Syrup. ferri iodidi ..... 15| c.cm. or f℥ss.
Fluidextracti nucis vomicæ..... 3|10 c.cm. or *ml*.
Aquæ cinnamomi ..... 75| c.cm. or f℥iiss.

M. Sig.: A teaspoonful three times a day for infantile syphilis.

Hysteria, especially when associated with anæmia and amenorrhœa, is improved by the systematic administration of iron.

In order to overcome the tendency which exists in neurasthenia to palpitation of the heart Zerner makes use of:—

℞ Ferri pyrophosphat.,
Zinci bromid. ..... aa 3 | 50 Gm. or gr. liv.
Tr. digitalis ..... 15 | c.cm. or f℥ss.
Extracti ergotæ ..... 12 | Gm. or 3iij.
Syr. aurant. ..... 22 | c.cm. or f℥vj.
Aq. destill. ..... 105 | c.cm. or f℥iiiss.
M. Sig.: From one to three teaspoonfuls a day.

Certain cerebral disorders depend more or less immediately upon anæmia, as some forms of puerperal mania and the insanity of lactation; chronic mania and melancholia, also, are not infrequently due to impoverishment of the blood. In all these cases the tincture of ferric chloride is a valuable remedy. The continued use of iron is very beneficial in rachitis. In this disease a combination of the ferric phosphate and calcium phosphate is especially advantageous:—

℞ Ferri phosphatis solubilis,
Calcii phosphatis præcipitat. ..... aa 8 | Gm. or 3ij.
Extracti nucis vomicæ ..... | 32 Gm. or gr. v.
Ol. eucalypti ..... | 30 c.cm. or *m*v.
M. et ft. pil. no. xl.
Sig.: Two pills three times a day.

The styptic preparations of iron, given internally, are useful in hæmorrhage. A drop or two of the nitrate or subsulphate solution, given in ice-water and frequently repeated, will usually check bleeding from the stomach; 0.30 to 0.60 c.cm. (or *m*v-x) of the tincture given upon shaved ice every half-hour is recommended in the hæmorrhagic vomiting of yellow fever. The tincture of the chloride is an excellent remedy in hæmorrhage from the bowels or kidneys, and in purpura hæmorrhagica. Iron is useful, likewise, in the treatment of menorrhagia. Profuse discharges from mucous membranes, due to chronic inflammation, are restrained by the exhibition of iron, which acts as an astringent and at the same time favorably modifies the nutrition of the cells. Chronic diarrhœa and dysentery, chronic bronchitis, prostatorrhœa, gleet, and leucorrhœa are ameliorated by a chalybeate course. Dilatation of the stomach, dependent upon or connected with anæmia, is sometimes improved by the administration of iron, and, owing to its beneficial effect upon the mucous membrane, the syrup of iron is useful in the treatment of thread-worms. (Four c.cm., or f℥j, of the tincture to 240 c.cm., or Oss, of water is a good rectal injection when these parasites are present.) By maintaining the quality of the blood and promoting nutrition, iron is of service in phthisis and emphysema. Affections of the heart are notably improved by this remedy. In fatty degeneration, dilatation, and valvular disease, iron is demanded, in order to maintain the quality of the blood and the nutrition of the heart and to promote compensatory growth. The anæmia and indigestion of Bright's disease also receive benefit from this remedy, especially in the form of the tincture of the chloride or acetate.

Bamberger prefers to use a pill containing 0.02 Gm. (or gr. $^1/_3$) of ferric chloride, three to six pills being given in the course of the day, or a pill of ferrous sulphate as recommended by Wiethe:—

℞ Ferri sulphatis,
Sodii bicarb. ..... aa 5 | Gm. or gr. lxxv.
Ext. taraxaci ..... q. s.
M. et ft. pil. no. lx.
Sig.: Three pills to be given in the morning and three in the evening.

In addition he regulates the diet and administers decoction of cinchona-bark.

The nocturnal incontinence of urine in children often yields to iron. This is especially true of strumous children, for whom the syrup of the iodide is the best preparation. Iron is remedial in spermatorrhœa when that affection is the result of anæmia and relaxation. Both amenorrhœa and dysmenorrhœa are often due to impoverished blood, and, when this is the case, are best treated by iron. The menstrual irregularity, anæmia, and neurasthenia so often seen in overworked and underfed women in our great cities are conspicuously benefited by the administration of the "four chlorides," as introduced by Professor Goodell. The combination may be made as follows:—

℞ Tinct. ferri chloridi ..... 9|25 c.cm. or f3iiss.
Hydrarg. chloridi corr. ..... |13 Gm. or gr. ij.
Liquor arseni chloridi ..... 9|25 c.cm. or f3iiss.
Acid. hydrochlorici dil. ..... 18|5 c.cm. or f3v.
Syrup. simplicis .....q. s. ad 120| c.cm. or f℥iv.
M. et ft. sol.
Sig.: Teaspoonful in water three times a day.

The vasomotor disturbances incident to the menopause are often relieved by full doses of the tincture of iron, given several times a day. Phagedæna usually occurs in dissipated and debilitated individuals, and iron internally materially assists the action of the appropriate topical applications.

Reduced iron, or Quevenne's iron, is in such a minute state of subdivision that it is readily acted upon by the acid of the gastric juice, and generally agrees with the stomach. As it is tasteless, it may be given to children in the form of chocolates, each containing 0.065 Gm. (or gr. j), and thus forms an excellent tonic for anæmic and poorly-developed children. When used for its systemic effect, small doses are as efficient as large ones; it is best given when digestion is active,—about half an hour after meals.

℞ Ferri reducti ..... 2|60 Gm. or gr. xl.
Sodii arsenatis ..... |065 Gm. or gr. j.
Extracti ignatiæ ..... |32 Gm. or gr. v.
Extracti gentianæ ..... 1|30 Gm. or gr. xx.
M. et ft. pil. no. xx.
Sig.: Take one three times a day, after meals, as a general tonic for an adult.

It is well to bear in mind that the prolonged administration of iron is liable to cause intestinal concretions.

The diuretic action of the tincture of the chloride is aided by saline combination. Thus, in chronic Bright's disease of the kidneys with œdema, we may give:—

℞ Tinct. ferri chloridi,
Acid. phosphoric. dilut. ..... aa 7|5 c.cm. or f3ij.
Glycerini ..... 30| c.cm. or f℥j.
Liq. ammonii acetatis .....q. s. ad 180| c.cm. or f℥vj.
M. Sig.: A tablespoonful three or four times daily in dropsy attending Bright's disease or pregnancy.

Instead of this, we may order the official solution of the acetate of iron and ammonium (Basham's mixture), or the following:—

℞ Tr. cantharidis ..... 4| c.cm. or f3j.
Tr. ferri chloridi ..... 60| c.cm. or f3ij.

M. Sig.: Give twenty to thirty drops, well diluted, four times daily, to be taken through a glass tube, in gleet.

The syrup of ferrous iodide is valuable in strumous skin diseases, in conjunction with codliver-oil. The same remedy, alone or in conjunction with codliver-oil, is of undoubted efficacy in the treatment of enlarged strumous glands prior to the occurrence of caseous degeneration.

In erysipelas comparatively large doses of the tincture of the chloride are well borne (2.50 to 4 c.cm., or *m*xl-f3j, every two hours) and exert almost a specific effect, rapidly checking the force and progress of the disease.

Special Preparations. — Among the best-known preparations are the solutions of **ferrous malate** and of **dialyzed iron**, both of which cause very little disturbance and rarely constipate. That the latter does exert astringent effects, however, may be inferred from the fact that Dr. W. Judkins has found it a useful remedy in the diarrhœa of childhood. **Lævulose ferride** is another very eligible preparation of iron, differing, in many respects, from the others. It is of alkaline reaction, agreeable to the palate and the stomach, and, it is said, can be mixed with the ordinary fluid extracts and tinctures without causing chemical union between the iron and the tannin and the formation of insoluble tannates. **Iron albuminate** is an aromatic, reddish-brown, alkaline solution, which is said to be more readily assimilable than other iron salts, less frequently the cause of gastric disorder, and is promptly assimilated, causing rapid increase in the globular richness of the blood. It may be given in milk (Dumont). Dr. J. A. Ouchterlony[1] finds it especially serviceable when anæmia and debility are associated with weak and irritable digestive organs.

The following are some modern organic preparations of iron:—

Liquor Mangano-Ferri Peptonatus.—Dr. Gude has prepared a solution of iron and manganese which is well adapted to the treatment of chlorosis, anæmia, and the various secondary ailments which depend upon a deficiency of red corpuscles and hæmoglobin. This solution is a clear, dark wine-colored fluid, of an agreeable, astringent, but non-metallic taste. It is given in the dose of a dessertspoonful to a tablespoonful three times a day, and is acceptably administered in milk. This preparation increases the appetite and has no prejudicial effect upon digestion. It can be steadily taken for a long period.

Hæmogallol.—This substance is obtained from hæmaglobin by treatment with pyrogallol. It is a reddish-brown powder, and is given in the dose of 0.13 to 0.50 Gm. (or gr. ii-viij). Hæmogallol is without taste and has no disturbing effect upon digestion.

Hæmol. — Hæmol is the zinc compound of hæmoglobin prepared by treatment with zinc dust. It is of a blackish-brown color and its dose is the same as that of hæmogallol. Hæmol has but a slight taste. Both hæmogallol and hæmol can be readily administered as powders in wafer or mixed with sugar and placed dry upon the tongue. They are readily absorbed and slowly eliminated. They have been beneficially employed in chlorosis, anæmia, and dependent conditions, and Dr. W. H. Porter, of New York, has given them in diabetes mellitus with reported good results. These preparations are

[1] Communication to Louisville Clinical Society, Oct. 22, 1889.

regarded as of particular service in the anæmia which accompanies Bright's disease.

A number of metallic compounds of hæmol have been prepared and proposed as substitutes for older salts. **Bromhæmol,** containing 2.7 per cent. of bromide, has been experimentally used in epilepsy. **Cuprohæmol,** in which 2 per cent. of copper is embodied, and the dose of which is 0.10 to 0.13 Gm. (or gr. iss-ij), is thought to be serviceable in anæmia, scrofula, and tuberculosis. **Ferrohæmol** is a compound of iron and hæmol; its dose is 0.50 Gm. (or gr. viij). **Iodohæmol** contains 1.66 per cent. of iodine. **Mercuroiodohæmol** is composed of 12.35 per cent. of metallic mercury and 26.68 per cent. of iodine, in addition to the hæmol. Metallic zinc in the proportion of 1.01 per cent. enters into the composition of **zincohæmol,** which is said to be very useful in diarrhœa and chlorosis.

Oviferrin.—A permanent, organic compound of iron and albumin of egg, discovered by Barnes and Hille, of Philadelphia. Its chemical formula is $C_{47}N_{17}SH_5Fe_8O_{22}$. It is a clear ruby-red solution, the usual dose of which is 15 c.cm. (or ℥ss) (corresponding to 0.065 Gm. (or gr. j) of reduced iron). It does not cause disturbance of the digestive function, nor cause constipation. The author has found it very valuable in anæmia, and in rheumatic and neuralgic conditions. It is almost tasteless, and is readily taken by children.

Ferratin.—This name has been given to a fine powder, reddish brown in color, obtained by Professor Schmiedeberg, of Strassburg, from hogs' liver. Ferratin, as a rule, contains 7 per cent. of iron. Ferratin is believed to be identical in form with the iron as contained in food. It occurs in two varieties, one of which is insoluble in water, while the other, combined with sodium, is readily dissolved in water by agitation. Water containing lime forms with it an insoluble calcium ferratin. The daily dose of ferratin is from 0.10 to 0.45 Gm. (or gr. iss-vij) for children and from 1 to 1.30 Gm. (or gr. xv-xx) for adults. Ferratin has been found valuable in the treatment of anæmia, and especially of chlorosis.

Hæmoferrum.—This is another new preparation of iron described as a natural proteid compound of iron obtained from bullock's blood. The advantages claimed for it are palatability, solubility, and freedom from disturbing effect upon stomach or bowels. It is given in 0.20 Gm. (or gr. iij) doses for the relief of debility and anæmia.

Iron-quinine chloride, a yellowish-red powder, soluble in water, alcohol, and glycerin, has been used, both externally and internally, as a hæmostatic. In hæmorrhage from accessible mucous membranes a concentrated solution, or the powder itself, may be applied to the bleeding surface. Gastro-intestinal and pulmonary hæmorrhages may be treated by the internal administration of this substance. The dose is from 0.10 to 0.20 Gm. (or gr. iss-iij).

FICUS (U. S. P., B. P.).—Fig.

Preparation.

Confectio Sennæ (U. S. P., B. P.). (See *Senna.*)

Pharmacology.—The fig-tree is a native of the south of Europe and is cultivated in the southern part of the United States. The official part is "the partially dried fruit of Ficus carica (Moraceæ)," which has a pleasant taste. Figs are used as food, and contain 62 per cent. of sugar, with

gum, fat, salts, etc. Mussi has obtained from the leaves and stems a new ferment-like principle, which he terms cradine. It is said to be more energetic than pepsin, and acts either in an acid or alkaline medium. It has no influence upon carbohydrates, but its action upon fats has not yet been studied.

Therapy.—Figs are slightly laxative, and may be used to correct a tendency to constipation, especially in children. The seeds act mechanically in stimulating peristalis. Split open and heated, they may be used, particularly in the mouth, to fulfill the indications of a poultice. The proprietary syrup of figs is said to owe its laxative quality to senna leaves.

FILIX MAS (B. P.).—**Male Fern.** See **Aspidium** (U. S. P.), page 237.

FLUORESCEIN.—This is the name given to a body which results from heating together resorcin and phthalic anhydride. It is of acid reaction, and, when freshly precipitated, readily soluble in ether and alcohol, slightly soluble in hot water, more freely soluble in alcoholic solution. Fluorescein is of a dark-brown color, becoming green when added to water, and the solution exhibiting a beautiful fluorescence. **Fluorescin** is made by heating fluorescein with a solution of caustic soda and zinc dust.

Therapy.—Fluorescein and fluorescin are of service from their property of staining abraded corneal surfaces, by which means such lesions may be readily located. They have no effect in ulcers of the cornea or interstitial keratitis. These substances may be used also for the purpose of determining the permeability of stricture of the nasal duct. Forced into the canaliculus, if there is the least opening through the occlusion, some of the green solution will find its way into the nose. Sixty-five centigrammes (or gr. x) of either substance may be dissolved in 30 c.cm. (or f℥j) of water by the addition of 0.50 Gm. (or gr. viiss) of sodium bicarbonate.

FŒNICULUM (U. S. P.).—**Fennel.**

FŒNICULI FRUCTUS (B. P.).—**Fennel-fruit.**
Dose, 1.30 to 2 Gm. (or gr. xx-℥ss).

Preparations.

Oleum Fœniculi (U. S. P.).—Oil of Fennel. Dose, 0.30 to 1 c.cm. (or *m*v-xv).
Aqua Fœniculi (U. S. P., B. P.).—Fennel-water. Dose, 7.5 to 30 c.cm. (or f℥ii-f℥j).

Pharmacology and Therapy.—"The dried, nearly ripe fruit of Fœniculum vulgare (Umbelliferæ)" contains an agreeable volatile oil (3 per cent.), which is used as a flavoring and carminative. It is an ingredient in the compound infusion of senna and compound spirit of juniper (U. S. P.), and compound licorice-powder (U. S. P., B. P.). Fennel-tea (infusion: 8 to 12 Gm. to 473 c.cm., or ℥ij-iij to Oj) is used to relieve colic in infants and in dysmenorrhœa. The oil may be added to purgative medicines for the purpose of preventing griping. Fennel has been thought to have an influence in promoting the secretion of milk.

FORMALDEHYDUM.—(See **Liquor Formaldehydi.**)

FRANGULA (U. S. P.).—**Frangula (Buckthorn).**

Preparation.

Fluidextractum Frangulæ (U. S. P.).—Fluid Extract of Frangula. Dose, 2 to 4 c.cm. (or f3ss-j).

Pharmacology.—"The dried bark of Rhamnus Frangula (Rhamnaceæ), collected at least one year before being used." It is a European species of a plant of which this country has a valuable variety in the California buckthorn, or Cascara sagrada. (See **Rhamnus purshiana.**) It contains a lemon-yellow, odorless, and tasteless glucoside, **Frangulin** (or rhamnoxanthin), insoluble in water, but soluble in alcohol or ether. The recent bark contains a gastro-intestinal irritant, which is lost or modified by age, and therefore it is directed that only bark that has been dried for a year shall be used. Old bark contains **Emodin**, probably the most valuable constituent. The fluid extract is made with diluted alcohol, and better represents the bark than the preparations made simply with water, as the decoction (1 to 16) or the extract.

Frangula communicates a deep-yellow hue to the urine and fæces.

Therapy.—Frangula is a good laxative or purgative, resembling senna in its action. It can be used during pregnancy and is improved by the addition of a small amount of some aromatic to prevent griping.

FRANKENIA. — Frankenia, Yerba Reuma. A California plant, the Frankenia grandiflora (Frankeniaceæ), is recommended as a mild astringent. It is best given as a fluid extract, made with diluted alcohol, in diseases of the mucous membranes, as catarrh, leucorrhœa, gonorrhœa, etc. Dose, 0.60 to 1 c.cm. (or *m*x-xv) of the fluid extract.

It has also been used with reported success as a local application in chronic rhinitis and ozæna, preferably in the form of a spray.

FRASERA.—Frasera, American Calumba. The root of Frasera Walteri (Gentianeæ) contains a bitter principle, **Gentiopicrin**, and a yellow, crystallizable substance, **Gentisic Acid.** It is used like gentian and other vegetable bitters. The fluid extract (alcoholic) is the best preparation. Dose, 2 to 4 c.cm. (or *m*xxx-f3j), several times daily, as a bitter tonic and gastric stimulant.

FRAXINUS.—Ash. The dried bark is bitter and astringent, containing bitter glucosides, **Fraxin** and **Fraxetin**, tannic acid, and volatile oil. It has been used in infusion in the treatment of intermittent fever. An infusion of the leaves has also been used; they are diaphoretic, diuretic, and purgative.

FUCHSIN.—Fuchsin, Rosaniline Hydrochloride, is a derivative of aniline, of special interest from the beautiful magenta-red solution which its greenish crystals make with water. Like other preparations of this group, it may happen to be contaminated with arsenic.

Dr. Elliot reports a case of Paget's disease in which remarkably good results were obtained by the application of an ointment containing 0.10 Gm. (or gr. iss) of fuchsin to 31 Gm. (or ℥j) of lanolin and 26 c.cm. (or f3vij) of rose-water. A 1-per-cent. alcoholic solution has been successfully used in some cases of traumatic erysipelas. The intralaryngeal injection of a 2-per-

cent. watery solution of boric acid, saturated with fuchsin, is said to be beneficial in tuberculous laryngitis. When administered internally, it colors the urine and the saliva; and also the fluids of the body, since the vision is affected (chromatopsia). It is claimed to have some influence over chronic kidney disease and that some cases of albuminuria have been arrested by it (given in doses of 0.03 to 0.25 Gm., or gr. ss-iv, daily, with some vegetable extract). This remedy has likewise been administered with asserted advantage in typhus fever.

FUCUS VESICULOSUS.—Fucus, Bladder-wrack, Gulf-weed. Fucus vesiculosus is an alga, or unicellular plant, growing to immense size, forming masses of sea-weed in the Atlantic Ocean, found principally in the gulf-stream. It occurs in dried pieces of dark-brown or greenish color, with a disagreeable, fishy odor, and a rather bitter, sea-water taste. It contains mucilage, a bitter extractive, small amounts of iodine and bromine, with chlorides, phosphates, etc. It is supposed to be alterative and to have the power of reducing obesity, probably from the observation that pigs feeding upon it in Ireland do not fatten. It has been used with some success in enlarged scrofulous glands, bronchocele, and psoriasis. The decoction (1 to 16) may be used before meals to take away the appetite for food, or if used warm it acts as an emetic. The fluid extract and solid extract are irrational preparations; the only form in which to obtain the effects of the plant is the recent decoction. A charcoal from the leaves has been used for goitre.

GALANGA.—Galangal, the dried rhizome of Alpinia officinarum (Zingiberaceæ), is a native of China, where it is highly prized as a medicine. It is aromatic, resembling ginger and anise, and contains a volatile oil and an acrid resin. Dose, 1 to 2 Gm. (or gr. xv-xxx).

Galanga is stimulating and carminative, resembling ginger or cubeb. It is an ingredient in the powder for colds or catarrh, "catarrh snuff," and is also used in lozenges for pharyngitis and coughs.

GALBANUM (B. P.).—**Galbanum.**

Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Preparation.

Pilula Galbani Composita (B. P.).—Compound Pill of Galbanum (equal parts of asafetida, myrrh, and galbanum). Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Pharmacology.—A gum-resin obtained from Ferula galbaniflua (Umbelliferæ), and probably from other allied plants. Like crude turpentine, it comes in tears or masses, often rough and dirty upon the surface. The taste and odor are characteristic and warm, bitter, and unpleasant. Galbanum contains a volatile oil, resin (60 to 67 per cent.), and gum. The purified resin contains 20 per cent. of **Umbelliferone,** combined and free, and about 50 per cent. of **Galbaresino-tannol** (Conrady). By dry distillation a beautiful blue oil is obtained agreeing in its characters with oil of Matricaria chamomilla. By infusing galbanum with potash, Hlasiwerth and Benth obtained resorcin (see **Resorcinum**).

Therapy.—As a local application, it is stimulant, and the plaster is used as a counter-irritant and resolvent over old swellings. Asafetida may be

combined with it, as in the formerly-official asafetida plaster. Internally it is an expectorant and antispasmodic. The compound pills of galbanum may be used in chronic bronchitis; also in chronic rheumatism and rheumatic affections. Some emmenagogic power has also been attributed to the compound pills of galbanum.

GALEGA.—Goat's-rue. Galega officinalis and Galega apolinea (Leguminosæ), indigenous plants, stimulate the secretion of milk. A watery extract possesses the properties and peculiar odor of the plant. In the daily dose of 4 to 6 Gm. (or 3i-iss), galega excites within a few days a notable augmentation of the milk. According to M. de la Carrière, the increase relates not only to the water, but to the globules also, as is shown by direct analysis.

GALIUM.—Cleavers, Bed-straw. The whole plant of Galium aparine (Rubiaceæ), a common indigenous herb, is used in domestic practice. Galium yields its virtues to water and alcohol, is bland to the taste, and devoid of bitterness or astringency. According to Dr. Eckfeldt, it is aperient, diuretic, and alterative. It may be used in the treatment of dropsy, incontinence of urine, jaundice, icterus neonatorum, and strumous manifestations associated with inactivity of liver and kidneys. Galium may be given in the form of an infusion or a fluid extract, the dose of which is 4 to 7.5 c.cm. (or f3i-ij).

GALLA (U. S. P., B. P.).—**Nut-gall, Galls.**

Preparations.

Tinctura Gallæ (U. S. P.).—Tincture of Nut-gall (20 per cent.). Dose, 2 to 11 c.cm. (or f3ss-iij).

Unguentum Gallæ (U. S. P., B. P.).—Nut-gall Ointment (20 per cent.).

Unguentum Gallæ cum Opio (B. P.).—Gall and Opium Ointment (gall ointment, 92.5 Gm., or 3xxiv; opium, 7.5 Gm., or 3i $^{7}/_{8}$).

Pharmacology.—Galls are "excrescences on Quercus lusitanica (Cupuliferæ), U. S. P.; Quercus infectoria (B. P.) caused by the punctures and deposited ova of the gall-fly, Cynips Gallæ tinctoriæ (class, Insecta: order, Hymenoptera)." Galls are small (2.5 cm., or 1 in., in diameter), hard, irregularly-spherical bodies. Externally, they are dark green or gray; internally, yellowish gray and dark in the centre, with a central cavity. The important constituents are tannic acid (40 to 75 per cent.) and gallic acid 2 to 3 per cent.). The Aleppo galls are considered to be the best; light-colored, spongy bulbs and so-called white galls are inferior. Their preparations are incompatible with metallic salts and generally form insoluble precipitates with alkaloids.

The powdered galls are very astringent locally to the skin and to the gastro-intestinal mucous membrane. Stockman doubts if they exert any astringent effect in the blood or by systemic action; any such action he considers as merely reflex, from the effect upon the stomach.

Therapy.—In the form of ointment, galls are used as an application to hæmorrhoids; a drachm of powdered opium to each ounce of nut-gall ointment is a good addition for this purpose. Nut-gall ointment is also a useful dressing to indolent ulcers, to eczema of the scalp after the scales have been removed, to herpes, fissured nipples, chilblains, and alopecia circumscripta.

It is also serviceable in prolapse of the rectum. Grose claims that an ointment containing 1 part of powdered galls to 8 of vaselin is efficacious in extensive burns, and that it restrains the tendency to subsequent cicatricial contraction.

The tincture of galls may be used, diluted with water, as a wash or gargle; but, for internal use, gallic or tannic acid is preferable. An infusion or decoction is sometimes made use of as an enema in diarrhœa and dysentery. The aromatic syrup of galls (containing galls, cinnamon, ginger, brandy, and sugar) is a pleasant astringent for children (dose, 2 to 4 c.cm., or *m*xxx-f℥j). (See also **Acidum Gallicum.**)

GAMBIR (U. S. P.).—**Gambir.** (See **Catechu.**)

GARRYA FREMONTII.—California Fever-bush, Skunk-bush. Garrya Fremontii is an evergreen shrub found in the higher localities of the mountains of California. The leaves, the part used medicinally, have little odor, but are very bitter to the taste. Mr. D. J. Ross claims[1] to have found in the leaves a new alkaloid, which he terms **Garryine.** Garrya possesses tonic and antiperiodic virtues and is said to be a reliable cholagogue. Excessive doses cause buzzing in the ears. A solid and a fluid extract have been prepared. The dose of the former is 0.03 to 0.065 Gm. (or gr. ss-j) and of the latter 0.60 to 2 c.cm. (or *m*x-xxx). Dr. Q. C. Smith, of Austin, Texas, writes that, from an experience of fifteen years, he regards this remedy as of more service than quinine in treating chronic or relapsing cases of malarial disease. He states that it is of value, also, in acute pulmonary inflammations.

GAULTHERIA.—Partridge-berry, Wintergreen, Tea-berry.

Preparations.

Oleum Gaultheriæ (U. S. P.).—Oil of Gaultheria. Dose, 0.12 to 1.20 c.cm. (or *m*ii-xx).

Spiritus Gaultheriæ (U. S. P.).—Spirit of Gaultheria (oil of gaultheria, 5 per cent. in alcohol). Dose, 0.60 to 1.30 c.cm. (or *m*x-xx).

Oleum Betulæ (U. S. P.).—Oil of Betula. Oil of sweet-birch (a volatile oil obtained by distillation from the bark of sweet-birch, identical with menthyl-salicylate and nearly identical with oil of gaultheria). Dose, 0.06 to 0.30 c.cm. (or *m*i-v).

Methyl Salicylas (U. S. P.).—Methyl Salicylate. Artificial (or synthetic) oil of wintergreen. Dose, 0.06 to 0.30 c.cm. (or *m*i-v).

Pharmacology. — The Gaultheria procumbens (Ericaceæ) is a small plant growing in the woods in North America; the leaves were formerly official; they contain a **volatile oil, Arbutin, Urson, Ericolin, tannic acid,** etc. The taste is aromatic, slightly bitter, and astringent; the flavor is agreeable. The volatile oil consists principally of **Gaultherilene** and **methyl-salicylate** (99 per cent.), which yields a pure salicylic acid. The oil of sweet-birch is frequently sold for oil of gaultheria, with which it is nearly identical. Methyl salicylas (U. S. P.) is the artificial, or synthetic, oil of wintergreen, and may be substituted for it. It is made by distilling salicylic acid with methylic alcohol and sulphuric acid.

Therapy.—The oil of gaultheria is antiseptic and antipyretic. It may be used in doses of 0.60 to 1.20 c.cm. (or *m*x-xx) in articular rheumatism

[1] *American Journal of Pharmacy*, 1877.

as a substitute for salicylic acid. It is efficacious, but is not as well tolerated as sodium salicylate on account of its local irritant properties. The oil, being a salicyl compound, is also used internally in both acute and subacute articular rheumatism with excellent results. In Bozzolo's clinic, where it was first used for rheumatism, it is now looked upon as the most available of the antirheumatics in the treatment of chorea in children. The oil of gaultheria, combined with its own weight of vaselin, is employed locally over painful points, and not only ameliorates the pain, but also acts beneficially upon the chorea. Schoull[1] says that it is more particularly in the articular manifestations of rheumatism that it is successful, especially as a means of relieving pain, which disappears very rapidly under its administration, much more so than with salicylate of soda. The swelling of the joints is somewhat longer in disappearing, as is also the temperature, and salicylate of soda seems, in this instance, more efficacious. It is therefore proposed to administer the two salicylates together, under which circumstances the similar dose of the soda salt can be employed. Schoull has also employed a combination of salicylate of methyl and antipyrin, and has thus obtained some surprising results in the reduction both of the pain and temperature. The author points out that the amount of urine should be watched during the administration of this drug. Salicylate of methyl is also of extreme advantage in subacute and chronic rheumatism, in which cases it presents a marked superiority over the soda salt. The same may be said of gouty arthritis. In certain other infective conditions as gonorrhœa, syphilis, and erythema nodosum, the effects, though good, are not so striking. The writer quotes Roger as having obtained very good results in the arthritic complications of eruptive fevers, especially scarlet fever, in which the action of antipyrin, salicylate of soda, or salophen, is slight. The drug is also efficacious in neuralgia, sciatica, some forms of neuritis, and herpes zoster, and lightning pains of tabes. Schoull has also tried salicylate of methyl in cases of orchitis from mumps and with remarkable results, all the symptoms disappearing in two days. Even in cases of epididymitis the effects are very favorable. The treatment of mumps itself by salicylate of methyl has been tried by Picard, of Troyes, with considerable success. Dr. John A. Wyeth, of New York, regards the oil of gaultheria as a serviceable remedy in the treatment of acute gonorrhœa. He administers it in 6-drop doses three times a day.

The decoction of the leaves or a fluid extract may be used in bowel disorders as an astringent. The infusion is in some parts of the country used as a substitute for tea at the table. It is also used as a galactagogue and emmenagogue. It is a good addition to liniments for rheumatic pains and swollen joints. A combination of equal parts of oil of wintergreen and olive-oil is a good application in such conditions.

Excessive doses of oil of gaultheria give rise to violent gastro-enteritis, followed by convulsions, coma, and death. Half an ounce has caused death; in another case recovery occurred after ingestion of the same quantity. A child, two years of age, died in convulsions, after swallowing 4 c.cm. (or 3j).[2]

Salicylamide.—This substance is made by treating oil of gaultheria saturated ammonia-water. It has also been prepared from artificial oil of

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[1] *Journal de Médecine*, March 10, 1899.

[2] *American Journal of Medical Sciences*, February, 1904.

wintergreen. Pure salicylamide occurs in the form of colorless and transparent crystals. It is without taste and is moderately soluble in water. It is claimed to possess the virtues of salicylic acid with greater analgesic power. Salicylamide has been given in doses of 3 to 5 grains repeated several times during the day.

GELATINUM (U. S. P., B. P.).—**Gelatin.**

GELATINUM GLYCERINATUM (U. S. P.).—**Glycerinated Gelatin, Glycerin Jelly** (gelatin, 100 Gm.; glycerin, 100 Gm.; water to make 200 Gm.).

By adding water and glycerin (of each 25 parts) to glycerinated gelatin (50 parts), gelatin suppositories may be made extemporaneously.

Pharmacology.—The air-dried product of the hydrolysis of certain animal tisues as skin, ligaments, and bones after treatment with boiling water. It occurs in translucent and almost colorless sheets or shreds. It dissolves in boiling water and (5 per cent.) makes a jelly on cooling. It is a basis of many agreeable and nutritive preparations for the sick, such as wine-jelly.

Therapy.—In eczema, where a dressing of more or less fixed character is required, gelatin in the following combination is often used:—

Gelatin	15 to 25 parts.
Zinc oxide	10 to 15 parts.
Glycerin	15 to 25 parts.
Water	50 parts.

To this may be added ichthyol, 2 parts; this is heated over a water-bath each time it is employed, a good coating painted on with a brush, and when partly dry the parts wrapped with gauze bandage.

In 1895 Dastre demonstrated that the injection of a solution of gelatin into the veins of a dog rendered the blood more coagulable. This discovery has been utilized in the treatment of aneurism of the first portion of the aorta. Prof. K. Barth[1] describes a case in which he used gelatin injections in the strength of 1 Gm. (or gr. xvss) in solution (1 per cent.) every second day until twelve injections were given; later a second course was carried out, and the examination after the latter showed a diminution of the dullness from a diameter of 4 $^1/_3$ inches to 2.34 by 1.95 inches; the subjective symptoms (pain, discomfort, inability to make any exertion) had entirely disappeared.

GELSEMIUM (U. S. P.).—**Gelsemium (Yellow Jasmine).**

GELSEMII RADIX (B. P.).—**Gelsemium-root.**

Dose, 0.13 to 1.30 Gm. (or gr. ii-xx).

Preparations.

Fluidextractum Gelsemii (U. S. P.).—Fluid Extract of Gelsemium. Dose, 0.12 to 0.60 c.cm. (or *m*ii-x).

Tinctura Gelsemii (U. S. P., B. P.).—Tincture of Gelsemium (10 per cent.; the British tincture is also 10 per cent.). Dose, 0.18 to 1 c.cm. (or *m*iii-xv).

Pharmacology.—"The rhizome and roots of Gelsemium sempervirens" (Loganiaceæ), U. S. P.; Gelsemium nitidum (B. P.): a climbing plant of the southern part of the United States.

[1] *Münchener medicinische Wochenschrift*, April 2, 1901.

Two bases have been extracted from gelsemium. **Gelsemine** is a crystallizable alkaloid; **Gelseminine** is amorphous, of a pale, grayish-brown color, bitter to the taste; readily soluble in alcohol, ether, or chloroform, and but slightly soluble in water. They exist in combination with Gelseminic Acid and a peculiar resin.

Physiological Action.—It has no special local action beyond slight sedative influence or astringency. Internally, it is a powerful motor depressant and sedative, motion being affected before sensibility, in warm-blooded animals. It acts especially upon the centres in the spinal cord and medulla. Small doses occasion injection of the conjunctivæ, pain in the eyelids, contraction of pupils (if locally applied or in very large doses it may cause dilatation), with drooping of the upper lid, or, more decidedly, vertigo and confusion of vision. Larger doses exert a paralyzing influence upon the spinal cord; the power of voluntary movement is progressively lost, numbness and staggering gait being observed as preliminary symptoms. Reflex irritability is lowered, the pupils dilate, and the sensory columns of the cord become paralyzed. No brain symptoms are produced directly, but the cerebral functions may be disturbed by the accumulation of carbonic acid in the blood, the result of paralysis of muscles of respiration. Death results from asphyxia. In animals convulsions may appear. Little effect is observed upon the heart directly; the pulse-rate is lessened by lowering the excitability of the excito-motor ganglia of the heart (Ott) and the arterial pressure by diminution of vasomotor tonus. It produces a decided lowering of the bodily temperature and is diaphoretic. Languor, muscular depression, and prostration occur.

Poisoning. — In cases suffering with toxic symptoms from an overdose, diffusible stimulants, hot drinks, friction to the surface of the body, and artificial respiration are useful, after evacuation of the contents of the stomach. Hypodermic injections of morphine and atropine are antagonistic to gelsemium. Tannic acid and caustic alkalies and their carbonates are chemically incompatible. In case of poisoning with gelsemium, the stomach should be promptly emptied by an emetic or the stomach-pump. External heat should then be employed, together with cardiac and respiratory stimulants, as digitalis, ammonia, atropine, and strychnine.

The smallest quantity of gelsemium which is known to have caused death is a teaspoonful of the fluid extract. In one fatal case Professor Wormley estimated that the quantity of fluid extract taken was equivalent to 0.01 Gm. (or gr. $^1/_6$) of gelsemine.

Therapy. — Gelsemium may be given to allay excessive nervous irritability, as in neuralgia, ovaralgia, tic douloureux, and in some cases of myalgia. Gelsemium is frequently beneficial in lumbago. It will often allay the pain of dental neuralgia. In facial neuralgia comparatively large doses of the tincture (0.60 to 1.20 c.cm., *m*x-xx), every two hours, are well borne. It has also been proposed as a remedy for tetanus, and might be useful in hydrophobia to control the spasms. In painful spasmodic affections the fluid extract or the tincture may be hypodermically administered either to supplement small doses of morphine, or as a substitute for this drug.

Dr. John B. Read treated a case of tetanus successfully by the administration of 2.50 c.cm. (or *m*xl) of the fluid extract every second hour until the symptoms began to ameliorate, when the dose was reduced by one-half and continued for several days.

Ringer has found the tincture, in 0.60-c.cm. (or *m*x) doses thrice daily,

beneficial in some cases of Ménière's disease. The same preparation, in 0.30 c.cm. (or *m*v) doses every quarter of an hour, will sometimes arrest an attack of bilious colic. In the spasmodic stage of whooping-cough, in asthma, laryngismus stridulus, and torticollis gelsemium has given relief. It is of service in migraine and in headache from eyestrain, in maniacal paroxysms, mania a potu, and insomnia. Certain fevers, notably cerebro-spinal and remittent, are benefited by the administration of gelsemium. When acute eczema is accompanied by considerable constitutional reaction, gelsemium may be given with marked advantage. This agent, likewise, especially when administered at bed-time, relieves the itching of eczema. It allays the pain of spasmodic dysmenorrhœa, favors dilatation of a rigid os in labor, and quells afterpains. It is of considerable service in the treatment of hæmoptysis. It is used in small doses as an antispasmodic in coughs, and in pneumonia and pleurisy. A full dose of gelsemium may prove successful in aborting an acute coryza. It is safer, on account of possible idiosyncrasy, to begin with very small doses of the tincture or extract, and gradually increase until slight drooping of the eyelid shows the beginning of full physiological effect. Gelsemium may be employed locally in the treatment of prurigo in the form of fluid extract, diluted. Dr. H. P. Nottage finds gelsemium exceedingly useful in influenza, all forms of catarrhal fevers, and, especially, in neuralgia where there is a tendency to recurrence or exacerbation on any particular day or time of day. He prefers small doses of a fluid extract made from the green root. It acts best when the pulse is large, full, quick, but easily obliterated by pressure. He has also found it useful in the headaches which occur at the menopause, together with flushings, the head and body hot, in 2- or 3-drop doses every three hours. It is useful in meningitis and convulsions, especially in childhood. In fractional doses (tincture diluted to $^1/_{10}$, and 2 drops given every two hours) it has been serviceable in vertigo, or dizziness. In chorea, when the usual remedies fail, gelsemium is worth trying.

In the dermatitis caused by Rhus radicans Dr. Edson has successfully used a lotion containing 7.5 c.cm. (or f℥ij) of the fluid extract of gelsemium to 120 c.cm. (or f℥iv) of water, a small quantity of carbolic acid and glycerin being also contained in the mixture. It has been also used as a mydriatic in eye practice.

GENTIANA (U. S. P.).—**Gentian.**
GENTIANÆ RADIX (B. P.).—**Gentian-root.**
Dose, 0.50 to 2 Gm. (or gr. viii-xxx).

Preparations.

Fluidextractum Gentianæ (U. S. P.).—Fluid Extract of Gentian. Dose, 2 to 4 c.cm. (or *m*xxx-f℥j).

Extractum Gentianæ (U. S. P., B. P.).—Extract of Gentian. Dose, 0.13 to 0.50 Gm. (or gr. ii-viij).

Tinctura Gentianæ Composita (U. S. P., B. P.).—Compound Tincture of Gentian (U. S. P. contains gentian, 10 Gm.; bitter orange-peel, 4 Gm.; cardamom, 1 Gm.; alcohol and water, each, q. s. ad 100 c.cm.). Dose, 4 to 7.5 c.cm. (or f℥i-ij).

Infusum Gentianæ Compositum (B. P.).—Compound Infusion of Gentian (contains gentian, 12.50 Gm.; bitter orange-peel, 12.50 Gm.; fresh lemon-peel, 25 Gm.; and distilled water, boiling, 1000 c.cm.). Dose, 15 to 30 c.cm. (or f℥ss-j).

Pharmacology.—Gentian is "the dried rhizome and roots of Gentiana

lutea (Gentianaceæ)": a native of Europe. Many species are indigenous, as the Gentiana puberula, G. saponaria, G. Andrewsii, and the beautiful G. crinita, which differ in therapeutical effects only in degree from the official gentian, and may be employed for like purposes. Both water and alcohol dissolve the active principle, which is very bitter, and appears to be a glucoside, **Gentiopicrin,** combined with **gentisic acid,** a coloring ingredient. There is no tannin present; although the preparations are darkened by most of the iron salts (the citrochloride is excepted), due to a change in this coloring matter, probably. Of the American varieties a decoction or infusion may be used, although a fluid extract would better represent the drug.

Physiological Action.—Gentian is a simple bitter, with little, if any, astringency, and has the same physiological action as others of this class. When combined with an alkali its local effects upon the stomach are much increased. From experiments upon dogs Dr. P. Terray concludes that gentian is the most powerful stimulant to the automatic movements of the stomach.

Gentian has been thought to exert a slight stimulant effect upon the liver. The chalybeates are synergistic, with reference to general tonic effects. It enjoys a reputation as a *succedaneum* for cinchona, as an antipyretic and antiperiodic, though to a less-marked degree; its actions have not been as much studied as those of the latter. No toxic effects have been noted.

Therapy.—As a stomachic tonic, the preparations of gentian are deservedly esteemed in cases of weak stomach during convalescence, catarrhal gastric disorder in infants, or ordinary atonic dyspepsia:—

℞ Sodii bicarb. ..... 15|5 Gm. or ʒiv.
Infusi gentianæ comp. ..... 180| c.cm. or fʒvj.
M. Sig.: A tablespoonful or two half an hour before meals.

It may be given with advantage in cases of atony of the stomach with a moderate amount of dilatation. The compound infusion of gentian is a good vehicle for administration of potassium iodide in cases where its tonic effects would be useful. Combinations of gentian and iron are numerous, but none are used so much as the Elixir Gentianæ cum Tinctura Ferri Chloridi (N. F.):—

℞ Elixir gentianæ ..... 120| c.cm. or fʒiv.
Tincturæ ferri citrochlorid. (N. F.) ..... 10| c.cm. or *m*clx.
M. Sig.: Two teaspoonfuls after each meal.

The gentian mixture official in the British Pharmacopœia is, according to Whitla, excelled by few remedies in the treatment of the vomiting of pregnancy, especially when combined with a mineral acid.

The infusion, or decoction, is useful as a stomachic in gastric disorders associated with gout or malarial fever, or the compound tincture may be used where the alcohol is not objectionable:—

℞ Tincturæ cinchonæ,
Tr. cardamom. comp. ..... aa 30| c.cm. or fʒj.
Tr. gentianæ comp. ..... 60| c.cm. or fʒij.
M. Sig.: A dessertspoonful to a tablespoonful in malarial dyspepsia and debility with loss of appetite.

Gentiana Quinquefolia.—The five-flowered gentian is common in the

United States. The whole plant is bitter, and may be given in infusion, but a fluid extract of the root would be better (dose, 0.30 to 2 c.cm., or *m*v-xxx). It may be used for the same purpose as the preceding.

GERANIUM[1] (U. S. P.).—**Geranium (Cranes-bill).**
Dose, 1 to 4 Gm. (or gr. xv-ʒj).

Preparation.

Fluidextractum Geranii (U. S. P.).—Fluid Extract of Geranium. Dose, 2 to 4 c.cm. (or *m*xxx-fʒj).

Pharmacology.—An indigenous plant, found in the woods from Canada to Florida, of which the rhizome only is official. The spotted geranium, as it is called, or Geranium maculatum (Geraniaceæ), contains tannic (13 to 17 per cent.) and gallic acids, which are its most important constituents, besides some resin, gum, starch, pectin, coloring matter, etc. According to the analyses of Trimble and Peacock, gallic acid does not exist in the plant, but is easily found in the rhizome after drying, and results from the easily-decomposable tannin. A crystalline vegetable principle has also been found in geranium by Dr. Edward Staples.

As geranium imparts its virtues to both water and alcohol, it may be used in decoction and tincture, as well as in the official fluid extract, which is made with dilute alcohol.

Physiological Action and Therapy.—Geranium improves the appetite and digestion and promotes nutrition. As it is decidedly astringent, the drug may be used, in fine powder, as a styptic in hæmorrhages after extraction of a tooth, epistaxis, etc. Its astringency renders it an excellent hæmostatic. The writer has obtained good results from the local application of the fluid extract, diluted with 3 or 4 parts of water, in buccal ulcer, fissure of the anus, and metrorrhagia. The same treatment promptly arrested a hæmorrhage from the urethra and at the same time cured a rebellious gleet which had been in existence for two years.

Geranium makes a useful throat- and mouth- wash:—

℞ Potassii chloratis	8	Gm. or ʒij.
Fluidext. geranii	22	c.cm. or fʒvj.
Glycerini	30	c.cm. or fʒj.
Aquæ rosæ q. s. ad	180	c.cm. or fʒvj.

M. Sig.: Add a tablespoonful to two tablespoonfuls or more of water, and use as a gargle.

In catarrhal inflammations, as an injection in gonorrhœa, gleet, and leucorrhœa, the decoction is more serviceable, according to Prof. L. Johnson, than a simple solution of tannin, doubtless from the fact that there is present mucilaginous material, which acts as a demulcent. The fluid extract is useful internally in diarrhœa. In infantile diarrhœa the decoction may be very acceptably administered in milk, which covers its taste. It is a valuable remedy in the early stages of phthisis, diminishing cough and expectoration, reducing the fever and pulse-rate, checking night-sweats and hæmoptysis. Under its use the appetite improves and the patient gains in weight. In a rapid case of phthisis, accompanied by profuse night-sweats, complete loss of appetite, and a severe, harassing cough, marked temporary relief was obtained by the following prescription:—

[1] See paper by author in the *Atlanta Medical and Surgical Journal*, Oct., 1889.

℞ Ol. menth. pip. ..... 1 | 20 c.cm. or *m*xx.
Fluidext. geranii ..... 45 | c.cm. or f℥iss.
Vini Portensis ..... 30 | c.cm. or f℥j.
M. Sig.: Teaspoonful every third hour.

Geranium is mild and unirritating, and especially suited to the later stages of diarrhœa and dysentery in children. It has also been employed in internal hæmorrhage, with good results.

GEUM.—Avens. Two species of Geum (Rosaceæ) are used in medicine: the Geum urbanum, or European avens, and the Geum rivale, or water avens, a native of North America. In each the root is the part possessing medicinal properties. Geum contains a bitter principle called **Gein** by Buchner, a little volatile oil, and a large proportion of tannic acid (10 to 40 per cent.). A recent infusion or decoction would best represent the physiological action of geum, though a fluid extract made with dilute alcohol is also used.

Therapy.—Avens is tonic and astringent. It is chiefly useful in relaxation of mucous membranes. An infusion made with boiling water is given for diarrhœa.

GILLENIA.—Gillenia, American Ipecacuanha. The Gillenia trifoliata, or Indian physic, and Gillenia stipulaceæ, which is a species closely resembling it, were formerly official, but have been dropped from the pharmacopœia, as they are very inefficient substitutes for ipecacuanha. They belong to the botanical family Rosaceæ, and are indigenous to this country, growing from Canada to Georgia. The part used is the root, which contains **Gillenin,** a peculiar bitter principle, to which its therapeutic properties are due. It also contains tannic acid, gum, resin, starch, etc. Dose of the root, 0.32 to 2 Gm. (or gr. v-xxx).

Physiological Action and Therapy.—Gillenia is an active emetic, and in small doses is thought to resemble ipecacuanha as a tonic and cholagogue; it is also diaphoretic and expectorant.

It has been used as a substitute for ipecacuanha, as an emetic, stomachic tonic, and diaphoretic, and in domestic practice in dyspepsia, etc.

GLANDULÆ SUPRARENALES SICCÆ (U. S. P.).—**Desiccated Suprarenal glands.**

GLANDULÆ THYROIDEA SICCA (U. S. P.).—**Desiccated Thyroid Glands.** (See **Animal Secretions,** page 203.)

GLONOINUM.—Glonoin (Nitroglycerin, Trinitrin), Glyceryl Trinitris.

Preparations.

Spiritus Glycerylis Nitratis (U. S. P.).—Spirit of Glyceryl Trinitris (1 per cent. by weight). Dose, 0.03 to 0.18 c.cm. (or *m*ss-iij).

Liquor Trinitrini (B. P.).—Solution of Trinitrin, Solution of Nitroglycerin (1-per-cent. alcoholic solution). Dose, 0.03 to 0.12 c.cm. (or *m*ss-ij).

Tabellæ Trinitrini (B. P.).—Trinitrin Tablets (chocolate tablets each containing 0.00065 Gm., or gr. $^1/_{100}$). Dose, 1 or 2.

Physiological Action.—*Nitroglycerin,* or *glonoin,* has the same physiological effects as amyl nitrite, but is usually administered in solution. The official Spiritus Glycerylis Nitratis, therefore, is preferable to the tablets. The action is slower, but more permanent, than that of amyl nitrite.

Antagonists. — The physiological antagonists to the action of amyl nitrite and nitroglycerin are strychnine, belladonna, sclerotinic acid, and, in general, those remedies which raise arterial tension and diminish blood-supply to the great centres by producing contraction of blood-vessels. In case of unpleasant or serious symptoms after its use, the exhibition of ammonia by inhalation and by the mouth, the hypodermic injection of atropine or ether, with cold water or ice-bag to the head, mustard poultice to the epigastric region or to the extremities, keeping the patient warm and in the recumbent posture, will very soon be followed by relief, as the symptoms are usually quite evanescent.

Therapeutic Applications.—Murrell praises this remedy highly, not only for typical angina, but for breathlessness and attacks of pseudo-angina. Da Costa has given it in Bright's disease attended by high arterial tension (cirrhotic kidney), in the following combination:—

℞ Glycerylis trinitritis		00065	Gm. or gr. $^1/_{100}$.
Tr. digitalis,			
Tr. strophanthi	aa	12	c.cm. or *mij*.
Tr. belladonnæ		03	c.cm. or *mss*.

M. et ft. tabella.

Sig.: Take one every six hours until effect upon the pulse is obtained.

In the treatment of angina pectoris and severe asthma Hoffmann[1] recommends subcutaneous injections of nitroglycerin in alcoholic solution in dose of 0.0005 to 0.001 Gm. (or gr. $^1/_{120}$-$^1/_{60}$). He claims remarkable results from these injections, without any objectionable after-effects.

Dr. Elliot Bates has, in a number of instances, seen very marked relief from the hypodermic injection of nitroglycerin in those cases of epilepsy where the patient falls with rigid limbs. He administered it in the dose of 0.00065 Gm. (or gr. $^1/_{100}$). Good results have been observed in hystero-epilepsy from the hypodermic injection of the same quantity, the spasm being controlled within a few minutes.

A few drops of the solution of nitroglycerin placed upon the tongue have been used with success in order to relieve the craving of the opium habituate. Dr. Speer records a case in which nitroglycerin was successfully employed in morphine poisoning, 0.38 Gm. (or gr. vj) having been taken by a lad aged 17 years. An injection of 0.0013 Gm. (or gr. $^1/_{50}$) was soon followed by an improvement in the respiration and, in half an hour, by vomiting, after which 0.00065 Gm. (or gr. $^1/_{100}$) was administered in the same manner. Two hours subsequently the patient was out of danger. Case reports great relief in Raynaud's disease from the injection, thrice daily, of the same quantity of nitroglycerin gradually increased to 0.0013 Gm. (or gr. $^1/_{50}$). In threatened collapse caused by pneumonia, drop doses of the 1-per-cent. solution, as advocated by Dr. Andrew H. Smith, of New York, act as a diffusible stimulant and often avert the danger.

Dr. Trussewitsch recommends the use of nitroglycerin in the algid stage of cholera. One or 2 drops of the 1-per-cent. solution placed upon the tongue causes dilatation of the peripheral blood-vessels, decreases the blood-pressure, and relieves the heart. Dr. Humphries employs nitroglycerin in various forms of vomiting with very good results. He has also found it valuable in acute or chronic gastric catarrh of the infant or adult, and has used it suc-

[1] *Pharmaceutical Journal and Transactions*, June 28, 1890.

cessfully in the vomiting of pregnancy. Given subcutaneously it acted as a prompt restorative in a case of poisoning from illuminating gas. Dr. D. D. Stewart points out that a tolerance to this remedy is sometimes readily acquired by patients, whose anxiety prompts them to increase the doses. This tendency must be guarded against by temporarily discontinuing the drug from time to time and resuming with a smaller dose than that last used.

A remarkable example of acquired tolerance to nitroglycerin has been placed upon record by Dr. G. E. Reading, of Woodbury, N. J. The patient, a woman, suffering from chronic interstitial nephritis, was placed at first upon the doses of 0.00065 Gm. (or gr. $^1/_{100}$), which was gradually increased until, in less than a year, she was taking an amount equivalent to 0.38 Gm. (or gr. vj). The symptoms of the disease were by this time apparently cured.

On account of the explosive properties of nitroglycerin, it is advisable not to accumulate too large a number of the tablets, nor to shake them violently. This objection, says Murrell, will not apply to the forms in which nitroglycerin is ordinarily dispensed, however. The 1-per-cent. solution, he adds, is perfectly safe, and may be used without fear; in fact, most chemists keep a 5-per-cent. solution. The same authority also gives a series of experiments made by himself in hammering and bringing a red-hot wire in contact with pills of nitroglycerin, thus demonstrating their safety. All pills and tablets of nitroglycerin may not be so safe as those he referred to.

GLUCOSUM.—**Glucose, Grape Sugar** ($C_6H_{12}O_6$).

GLUSIDUM (B. P.).—**Gluside.** **BENZOSULPHINIDUM** (U. S. P.).—**Saccharinum.** (See **Benzosulphinidum.**)

Gluside, or benzoyl-sulphonicimide, is a sweet imide derived from toluene. Its constitution is represented by the formula

$$C_6H_4 < \begin{matrix} CO \\ SO_2 \end{matrix} > NH \text{ -181.77}$$

Gluside, or saccharin, is a light, white, minutely-crystalline powder having an intensely-sweet taste in dilute solutions. It is soluble in 400 parts of cold water, 24 of boiling water, in 25 parts of alcohol (90 per cent.), and but slightly in ether or chloroform.

On account of its sweet taste, gluside is in use commercially as an addition to glucose, especially in the form of cheap confectionery. As its effects on the animal organism are scarcely toxic, 5 Gm. (or 3i $^1/_4$) being administered without any obvious effects, in a man, it has been employed in the diet of diabetes, as a substitute for sugar, in sweetening coffee or other articles of food. It is made into tablets with bicarbonate of soda to increase its solubility. The usual dose is 0.13 to 0.20 Gm. (or gr. ij-iij).

GLYCERINUM (U. S. P., B. P.).—**Glycerin (Glycerol).**

Dose, 4 to 15 c.cm. (or f3i-iv). B. P., 4 to 7.5 c.cm. (or f3i-ij).

U. S. P. Preparations.

Glyceritum Acidi Tannici.—Glycerite of Tannic Acid (20 per cent.). For external use.

Glyceritum Amyli.—Glycerite of Starch (glycerin, 80; starch, 10 parts). For external use.

Glyceritum Boroglycerini.—Glycerite of Boroglycerin. Solution of Boroglyceride.

Glyceritum Hydrastis.—Glycerite of Hydrastis. (Each c.cm. = 1 Gm. of Hydrastis.)

Glyceritum Phenolis.—Glycerite of Phenol (20 per cent.).

Glyceritum Ferri, Quininæ, et Strychninæ Phosphatum.—Glycerite of the Phosphates of Iron, Quinine, and Strychnine.

Suppositoria Glycerini.—Glycerin Suppositories.

B. P. Preparations.

Glycerinum Acidi Borici.—Glycerin of Boric Acid. For external application.

Glycerinum Acidi Carbolici.—Glycerin of Phenol (16 $^{2}/_{3}$ per cent.).

Glycerinum Acidi Tannici.—Glycerin of Tannic Acid (16 $^{2}/_{3}$ per cent.).

Glycerinum Aluminis.—Glycerin of Alum (14 $^{1}/_{2}$ per cent.).

Glycerinum Amyli.—Glycerin of Starch (11 per cent.).

Glycerinum Boracis.—Glycerin of Borax (14 $^{1}/_{4}$ per cent.).

Glycerinum Pepsini.—Glycerin of Pepsin (4 c.cm., or f3j, contains 0.32 Gm., or gr. v, of pepsin). Dose, 4 to 7.5 c.cm. (or f3i-ij).

Glycerinum Plumbi Subacetatis.—Glycerin of Lead Subacetate.

Glycerinum Tragacanthæ.—Glycerin of Tragacanth.

Suppositoria Glycerini (B. P.).—Glycerin Suppositories (each suppository contains 70 per cent. of glycerin).

Unguentum Glycerini Plumbi Subacetatis.—Lead-Subacetate Ointment (glycerin of lead subacetate, 1; white paraffin ointment, 5 parts).

Glycerin is also a constituent in several U. S. P. extracts, fluid extracts, pill masses, mucilage of tragacanth, solution of pepsin, and other preparations.

Pharmacology.—Official glycerin is "a liquid obtained by the decomposition of vegetable or animal fats or fixed oils, and containing not less than 95 per cent. of absolute glycerin." In the process for making lead plaster, the olive-oil, being decomposed by the lead oxide, yields lead oleate and free glycerin. It is also produced in the ordinary process of soap-making, being a constituent of the waste, from which it is now recovered in large quantities for commercial purposes. A purer glycerin is obtained by decomposing fats by steam, or superheated water, and distillation. A superior article is made from vegetable fats by Messrs. Proctor & Gamble, of Cincinnati, which is best adapted for medical use. The British Pharmacopœia defines glycerin as "a trihydric alcohol associated with a small percentage of water. It is obtained by the interaction of alkalies or of superheated steam, with fats and fixed oils." It is colorless, resembling syrup, oily to the touch, without odor, very sweet, slightly warm to the taste, neutral in reaction, hygroscopical, soluble in all proportions in water or alcohol, and insoluble in ether, chloroform, benzol, or fixed oils. Under certain conditions it becomes a mass of dense, brilliant crystals, but may be cooled to — 40° C. without congealing, only becoming more viscid. Treated with strong nitric acid, it forms glonoin, or nitroglycerin: a substance of powerful explosive properties.

Physiological Action.—As it has an affinity for water, glycerin absorbs the latter from mucous surfaces and excites secretion. It is irritating in its concentrated state to both skin and mucous membrane, being entirely different in its effects from oils or fats, although, when diluted, it keeps the skin moist and prevents cracking or chapping. Glycerin is absorbed by the skin and passes into the blood. It has very little effect upon the stomach. A certain amount is absorbed, with the effect of increasing nutrition and improving the appetite; it is slightly laxative, and is said to lessen the excretion of urea, though, according to the experiments of Lewin, it exerts no influence upon the quantity of urea eliminated. Large doses have produced

hæmoglobinuria, owing to some action, as yet unexplained, upon the blood. In these cases the urine, according to Fuchsinger, contains the coloring matter of the blood, but no free corpuscles.

In the case of a man who was accustomed to taking 90 c.cm. (or f℥iij) of glycerin daily, but who used no alcoholic liquor, extreme cerebral excitement was produced, according to the statement of Constantin Paul.

Glycerin is considered antiseptic, yet Koch found that it did not destroy spores nor the activity of formed ferments, although a solution in water (1 to 3) arrests the action of some enzymes (pepsin, ptyalin, emulsin), and a stronger solution (1 to 2) prevents the action of others (myrosin, diastase, invertin), but preserves their activity unimpaired, and is used to preserve them (Wernitz). Glycerin is destructive to parasites, intestinal and external. It increases the action of codliver-oil, and is a solvent for some of the alkaloids, though not for others. Owing to its sweetness, it has been used as a substitute for sugar in the diet of diabetics, though saccharin has now largely taken its place. According to the clinical observations of Pavy, glycerin increases polyuria, and he therefore opposes its use as a substitute for sugar. It seems to augment considerably the quantity of glycogen contained in the liver, though it probably prevents the transformation of glycogen into sugar.

Therapy.—Diluted with 3 parts of rose-water, glycerin is a good application to the hands and lips to prevent chapping during cold weather. Glyconin is also used for this purpose. The same mixture is one of those employed in ichthyosis, after a warm-water, hot-air, or vapor-bath, in order to protect the diseased area and aid in maintaining its nutrition. In more concentrated form it has been used with success in pityriasis, pruritus, acne, eczema, fissured nipples, or acute coryza, applied with a brush or spray. In combination with collodion ($^1/_2$ per cent.) it forms collodium elasticum, which is less painful than pure collodion, and is a good protective for fissures and abrasions. The daily application of glycerin is capable of causing a steady reduction in the size of hypertrophied tonsils. The glycerite of tannic or of gallic acid is a useful astringent as an application for sore throat, relaxation of mucous membrane, and upon tampons to the cervix uteri for leucorrhœa. A pledget of absorbent cotton, saturated in glycerin, is an excellent application, also, in congestion of the womb, as, on account of its affinity with water, it provokes an abundant serous transudation. The glyceritum vitelli is used as a vehicle for chloroform or heavy powders. Glycerin alone, or with some astringent or sedative, is useful in preventing bed-sores. Injected into the bowels, it is a mild enema, and in small quantities is efficient in evacuating the lower bowel, and may be introduced in the form of suppositories.

In obstruction by fæcal impaction, the injection of several ounces into the colon, through a long tube, was successful in the hands of Dr. Edward Mayer, of Wilkes-Barre, Pa., in saving life after failure of all ordinary means of relief. Glycerin administered by the mouth has a peculiarly soothing effect upon inflamed and painful hæmorrhoids. Equal parts of glycerin and distilled water may be used as an application to keep the tongue moist in typhoid and other fevers; and a dilute solution may be sipped to moisten the throat during an attack of tonsillitis or pharyngitis, although the direct application by spray or brush should not be omitted. The red, dry, and glazed mouth of advanced phthisis is moistened by the use of a wash of glycerin and water. Reflex cough is often allayed by the application of

glycerin to the fauces, and, administered internally in 4-c.cm. (or f3j) doses, the same agent may prove of advantage in the cough of phthisis. It may be given to infants as a laxative in combination with oil. Administered alone, it has been used for the same purposes as codliver-oil, but is less efficient, although possessing some nutritive properties. It is the best remedy in cases of trichiniasis, administered in tablespoonful doses, as successfully used by Dr. James M. Barton; and is used as a laxative in cases of piles. Some forms of indigestion are improved by its administration after meals; and it is the best solvent and preservative for pepsin, either from the pig or the calf, the latter having been introduced by Dr. Frank Woodbury as the special digestive ferment for infants or adults upon a milk diet. In acidity of the stomach and flatulence, glycerin in 4-c.cm. (or f3j) doses two or three times a day is beneficial. It is often extremely useful in improving the appetite. Dr. J. A. Pollard esteems glycerin as of value in preventing stomach trouble during convalescence from debilitating diseases. He claims also that it has considerable power to control the vomiting of pregnancy. Ferrand regards glycerin as a valuable remedy in biliary lithiasis and as a powerful cholagogue, capable of affording relief in hepatic colic. In 18.5- to 22-c.cm. (or f3v-vj) doses it terminates the attack. In 4- to 7.5-c.cm. (or f3i-ij) doses, taken every day in a little alkaline water, it prevents fresh attacks. According to the experiments of A. Hermann, its action is mechanical and depends upon its power to abstract water from tissues.

Glycerin given in the form of suppository is often serviceable in relieving and overcoming constipation, especially when the lower bowel is inactive. (Professor Remington recommends as the best formula for glycerin suppositories: 40 grains of sodium carbonate, 80 grains of stearic acid, and 1080 grains of glycerin. The sodium carbonate is dissolved in the glycerin, the stearic acid added, and the mixture is carefully heated upon a water-bath until effervescence ceases. The solution is then poured into a suppository-mold to make 12 suppositories.) Gelato-glycerin bougies are useful in earache. Richards states that further experience has convinced him more than ever of the value of gelato-glycerin bougies in an early stage of acute otitis media and in acute otitis externa. They can be inserted in the ear without difficulty by simply washing off the lycopodium powder with which they are covered; they are then very slippery, and, with the affected ear uppermost, easily slip down into the canal. Here the bougie soon dissolves, the anodyne is brought directly into contact with the inflamed surfaces, and the pain is relieved. Besides being a medium for the exhibition of other remedies, the glycerin is of itself distinctly curative, in that it tends to draw out more serum from within and lessen the tension. After insertion the ear should be stoppered with absorbent cotton or gauze, and a lightly-filled hot-water bottle placed at the side of, or over the ear. Many a case of acute earache in children will, if promptly treated in this manner, at once subside without going on to severe inflammation. The following formula is recommended:—

℞ Phenolis liquefact.		43 c.cm. or *m*vij.
Tinct. opii deodorat.		37 c.cm. or *m*vj.
Cocainæ,		
Atropinæ sulphatis	aa	20 Gm. or gr. iij.
Aquæ		3 20 c.cm. or *m*lij.
Gelatin.		1 20 Gm. or gr. xviij.
Glycerini		9 60 c.cm. or f3ii*m*xxxviij.

M. et ft. bougies xlij.

After making, they should be covered with lycopodium, and dispensed in a bottle, as they are hygroscopical. They should be no larger than will readily slip in the external canal. The size made in urethral-bougie mold has proved satisfactory.[1]

Griffith has employed it with marked effect in the treatment of constipation. An enema of glycerin and infusion of flaxseed (1 to 4) allays tenesmus in cases of acute dysentery (Bartholow).

The injection, under strict antiseptic precautions, of about 150 c.cm. (or f℥v) of glycerin into the womb has been successfully practiced in order to excite premature delivery. The tube of the syringe is introduced as far back as possible, between the wall of the uterus and the membranes. According to Pelzer, from 30 to 45 c.cm. (or f℥i-iss) are sufficient to accomplish the purpose. In the experience of Dr. Embden, this practice is not without danger, and is liable to cause thrombosis or decomposition of the blood. He thinks also that it may lead to the introduction of air into the circulation.

Semmola asserted that glycerin has antipyretic action in acute infectious diseases, in which he administers it as follows:—

℞ Glycerin. ..... 60| c.cm. or f℥ij.
Acidi tartarici vel citrici ..... 5| Gm. or 3i 1/4.
Aquæ ..... 570| c.cm. or f℥xix.

M. Sig.: Three tablespoonfuls, or an ounce and a half, to be taken every hour, or half that quantity every half-hour.

Herman[2] states that, out of 115 cases of nephrolithiasis, in 15 cases concretions were passed and improvement was noticed in the patients' complaints; in 29 cases concretions passed without bringing about any such improvement; in 25 cases there was improvement only of the patients' condition without any concretions being passed; in 46 cases glycerin had no effect whatever. Thus, glycerin proved to be efficacious in 60 per cent. of the cases so treated, either by removing concretions or else by removing the pain which accompanies this disease. He administers the drug according to the weight and age of the patient, and states that 31 to 124 Gm. (or ℥i-iv), by weight, is his usual dose. He gives it in equal parts of water, at one dose, between two meals, and repeats it two or three times during several days. He has never had any disagreeable symptoms from it.

Externally glycerin can be combined with admirable effect as follows:—

℞ Glycerini,
Liquor calcis,
Aquæ rosæ ..... aa 60| c.cm. or f℥ij.

M. For excoriations, erythema, superficial burns, and scalds.

℞ Glycerini,
Aquæ hamamelidis
Aquæ rosæ ..... aa 60| c.cm. or f℥ij.

M. Use on chapped face and hands, sore nipples, and hæmorrhoids.

℞ Glycerini,
Aquæ hamamelidis ..... aa 90| c.cm. or f℥iij.
Bismuth. subnit. vel sodii bicarbonatis ..... 8| Gm. or 3ij.
Phenolis liquefact. ..... |60 c.cm. or *mx*.

M. For erythematous or vesicular eczema, burns, and seborrhœa, especially around the axilla and genital organs.

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[1] *Journal of the American Medical Association*, 1900.
[2] *Medical Chronicle*, 1899.

℞ Glycerini,
Acidi lactici,
Aquæ rosæ ..... aa 15| c.cm. or f℥ss.
M. For freckles and other pigmentations of the skin.

℞ Glycerini .....150| c.cm. or f℥v.
Creosoti ..... 4| c.cm. or f℥j.
Ol. menth. pip. ..... |60 c.cm. or *m*x.
M. Valuable for catarrh, pharyngitis, and laryngitis, in the form of a spray. It can be mopped on the skin or sprayed over the surface for pruritus, eczema, and urticaria.

The glycerite of starch is a bland material, which can be impregnated with various medicaments, astringents, etc., for application to the eye or to the skin. Glycerin is a good vehicle for alkaloids, and it is thus used in various diseases of the ear, in abnormal dryness of the external auditory canal, and impaction of cerumen.

Glycerite of Bismuth Borate was recommended by Keyser as a good remedy in phlyctenular and scrofulous conjunctivitis.

Unna has devised a preparation termed casein ointment which may be noticed in this place. It consists of 14 parts of casein, about $^1/_2$ part of potassium and sodium hydroxide, 7 parts of glycerin, 21 parts of vaselin, 1 part of salicylic or boric acid, and about 56 parts of water. It is a thick, white emulsion, which soon dries upon the skin and has been used in affections of the skin accompanied by itching. Various drugs may be incorporated with the ointment.

The urine of persons using glycerin reduces copper in Fehling's test, and, being mistaken for glycosuria, is liable to lead to error. This is not due directly to the presence of glycerin, but to a decomposition-product.

GLYCOGEN.—Glycogen is a proximate principle of the human body, where it is found in the liver and also in the nucleus of the leucocytes. It is also found in some fungi (mushrooms). It is a stimulant to the circulation, sustaining the heart, neutralizing toxines, and probably facilitates phagocytosis. It has been used in tuberculosis, diabetes, albuminuria, neurasthenia, anæmia, and infectious conditions. In migraine, it is claimed to be especially effective, giving prompt relief. It may be administered subcutaneously, or in capsules (0.06 Gm. or gr. j each). Dose, 1 to 5.

GLYCERYLIS TRINITRIS, AND SPIRITUS GLYCERYLIS NITRATIS (U. S. P.).—(See **Glonoinum.**)

GLYCYRRHIZA (U. S. P.).—**Glycyrrhiza (Liquorice-root).**
GLYCYRRHIZÆ RADIX (B. P.).—**Liquorice-root.**

Preparations.

Extractum Glycyrrhizæ Purum (U. S. P.).—Pure Extract of Glycyrrhiza. Dose, 0.32 to 4 Gm. (or gr. v-3j).

Fluidextractum Glycyrrhizæ (U. S. P.).—Fluid Extract of Glycyrrhiza (made with aqua ammonia and alcohol). Dose, 1.20 to 4 c.cm. (or *m*xx-f3j).

Elixir Adjuvans (U. S. P.).—Adjuvant Elixir (contains fluid extract licorice, 120 parts; aromatic elixir, 880 parts.) As a vehicle.

Mistura Glycyrrhizæ Composita (U. S. P.).—Compound Mixture of Glycyrrhiza, Brown Mixture (pure extract, 3; paregoric, 12; antimonial wine, 6; spirit of nitrous ether, 3; mucilage of acacia, 10; syrup, 5; and water, q. s. to make 100 c.cm.). Dose, 4 to 15 c.cm. (or f3i-iv).

Trochisci Glycyrrhizæ et Opii (U. S. P.).—Troches of Glycyrrhiza and Opium (extract of licorice and pulv. opium, with ol. anise, sugar, and acacia). Dose, 1 or 2.

Glycyrrhizinum Ammoniatum (U. S. P.).—Ammoniated Glycyrrhizin (for flavoring).

Extractum Glycyrrhizæ (U. S. P., B. P.).—Extract of Glycyrrhiza (extract of liquorice, B. P.).

Pulvis Glycyrrhizæ Compositus (U. S. P., B. P.).—Compound Powder of Glycyrrhiza (U. S. P. contains senna, licorice-root, powdered; oil of fennel, washed sulphur, sugar). Dose, 4 to 8 Gm. (or f3i-ij).

Extractum Glycyrrhizæ Liquidum (B. P.).—Liquid Extract of Liquorice. Dose, 2 to 4 c.cm. (or f3ss-j).

Pharmacology.—The dried rhizome and root of Glycyrrhiza glabra, which yields the Spanish, French, or Sicilian licorice; or of G. glandulifera, yielding the Russian licorice (Leguminosæ), United States Pharmacopœia, "the peeled root and peeled subterranean stem of Glycyrrhiza glabra and other species" (B. P.). This plant is a native of southern Europe. The root contains an amorphous, bitter-sweet glucoside, **Glycyrrhizin**, which is probably in combination with ammonia; it also contains **Asparagin**, sugar, resin, starch, gum, pectin, coloring-matter, etc. Glycyrrhizin, when acted upon by dilute acids, splits up into sugar and a brownish-yellow, bitter substance, **Glycyrrhetin**. The resin is also bitter.

The aromatic glycyrrhizin masks the taste of sulphate of quinine when prescribed with it in about double the quantity, but the after-taste is still bitter. The elixir of aromatic glycyrrhizin is a good vehicle in which to administer sulphate of quinine, but no acid should be added, since the quinine is largely suspended and not dissolved. Licorice enters into the other adjuvant elixirs for the administration of bad-tasting medicines. A syrup of licorice may be used as a flavoring agent or as a vehicle.

Physiological Action.—Licorice-root is demulcent and slightly stimulating to the bronchial mucous membranes, and is laxative. It has an agreeable taste, the bitterness being masked by the sweet principle, but leaves an acrid taste in the fauces. The extract covers the taste of other remedies. The root is used as a dusting-powder and coating for pills.

Therapy.—The compound infusion of flaxseed (U. S. P., 1870) is a good demulcent in acute bronchitis and diarrhœa. The extract is useful in relieving dryness of the throat and hoarseness, especially if combined with ammonium chloride. The troches contain 0.005 Gm. (or gr. $^1/_{14}$) of opium, and may be used where an opiate is not objectionable, but are dangerous, since their pleasant taste leads children to take an overdose; one every hour is sufficient for an adult with irritable cough.

The compound mixture is a good expectorant for bronchitis, and is often combined with syrup of senega and ammonium chloride.

In constipation, especially during pregnancy, the compound licorice-powder is very valuable; given at night on retiring, it causes one or two natural stools in the morning, generally without griping. Where a more decided effect is desired, it may be combined with an equal portion of compound jalap-powder.

GOSSYPIUM PURIFICATUM (U. S. P.), **GOSSYPIUM** (B. P.).—Purified Cotton.

GOSSYPII CORTEX (U. S. P.).—Cotton-root Bark.

Preparations.

Gossypium Purificatum (U. S. P.).—Purified Cotton (absorbent cotton).
Fluidextractum Gossypii Radicis.—Fluid Extract of Cotton-root Bark. Dose, 2 to 4 c.cm. (or f3ss-j).
Oleum Gossypii Seminis (U. S. P.).—Cotton-seed Oil.
Pyroxylinum (U. S. P.).—Pyroxylin, Collodion Cotton. Soluble gun cotton.

Pharmacology and Therapy.—Cotton is a native of the southern portion of the United States, and is "the hairs of the seed of Gossypium herbaceum (Malvaceæ) and of other species of Gossypium freed from adhering impurities and deprived of fatty matter." The British Pharmacopœia directs "the hairs of the seed of Gossypium barbadense, and of other species of Gossypium, freed from fatty matter." It is composed almost entirely of cellulose, and is in a mass of white, interlacing fibres, forming sheets of so-called carded cotton-wool. By a preliminary treatment with alkalies to extract the fatty matters, it becomes absorbent cotton, which is of great value in modern surgical practice, and has succeeded the sponge as a dressing for wounds. Absorbent cotton may be treated with various agents, so as to be of special value (carbolized, borated, salicylated, or treated with mercuric chloride, etc.). These are used to exclude air from wounds, burns, etc., and afford some support, and may also be applied to a blister after puncture. In inflammations, as in acute articular rheumatism, the part may be enveloped in cotton, either dry or moistened with anodynes, with great comfort to the patient. It is also a good material for tampons, or for making an artificial ear-drum after perforation. Cotton is much in use as a padding for splints. Dr. Whitla speaks very favorably of its use in phlegmasia dolens, enveloping the entire limb in a thick layer surrounded by oiled silk and carefully bandaged. Hæmostatic cotton may be made by dipping absorbent cotton in a solution of ferric chloride, and afterward drying and picking it, or dilute Monsel's solution may be used (1 in 24) and the cotton kept immersed in it until used as a tampon, in uterine cancer, etc.

Pyroxylinum, or gun-cotton, is official only as a component of collodion.

The oil of the seeds is bright, pale, odorless, and free from acrid aftertaste. It is a good substitute for olive-oil, and is frequently sold for it. It enters into the U. S. P. official liniments of ammonia and of camphor. In pharmacy it answers a similar purpose to olive-oil.

The bark of the root of gossypium contains resin, tannic acid, and a red coloring matter. A solid and a fluid extract can be obtained (both alcoholic), the dose of the former being 0.065 to 0.32 Gm. (or gr. i-v); of the latter, 2 to 4 c.cm. (or f3ss-j). A recent decoction is also used in the South. It has a special action upon the uterus, like ergot, and is employed in the same class of cases—in scanty menstruation, dysmenorrhœa, and during labor. Phillips has found it useful in hæmoptysis, and in the West Indies it is administered in dysentery.

Dr. Poteyenko has extended the use of cotton-root bark to other hæmorrhages. He speaks particularly of a case of persistent epistaxis which had resisted various internal and topical remedies, but which was promptly and permanently checked by the administration of 1.54 c.cm. (or *m*xxv) of the

fluid extract thrice daily for three days. Dr. Garrigues has found this drug of special service in chronic uterine hæmorrhages, even when these depend upon fibroids or carcinoma.

GRANATUM (U. S. P.).—**Pomegranate.**

GRANATI CORTEX (B. P.).—**Pomegranate-bark.**

Dose, 4 to 8 Gm. (or ʒi-ij).

Preparation.

Fluidextractum Granati (U. S. P.).—Fluid extract of Pomegranate. Dose, 1.3 to 2 Gm. (or *m*xx-xxx).

Decoctum Granati Corticis (B. P.).—Decoction of Pomegranate-bark (20 per cent.). Dose, 15 to 60 c.cm. (or fʒss-ij).

Pelletierinæ Tannas (U. S. P.)—Tannate of Pelletierine.

Pharmacology.—Pomegranate is "the dried bark of the stem and root of Punica granatum (Punicaceæ)," cultivated in subtropical countries. The rind of the fruit, though it is not official, contains very similar constituents, and is also useful. The liquid alkaloid, **Pelletierine** ($^1/_2$ per cent.), is found in this plant in combination with punico-tannic acid, and to these the peculiar virtues of the bark are due. The tannic acid is largely in excess (20 to 28 per cent.). It has been shown that Pelletierine is a mixture of four alkaloids, three of which are liquid and one solid. Pelletierine is a colorless aromatic, oily fluid, soluble in water, alcohol, ether, and chloroform.

According to Professor Flückiger, the commercial pelletierine tannate is a mixture of the tannates of the total alkaloids of pomegranate-bark.

Physiological Action and Therapy.—Pomegranate has powerful astringent properties, and a decoction flavored with orange or aromatics is useful in sore throat or pharyngitis, and as an astringent injection for gonorrhœa. Coronedi has determined that pelletierine acts as a muscle-poison and probably produces a condition of rigidity. In excessive amount pelletierine is stated to have an action similar to that of curare, paralyzing motor nerves without influencing muscular contractility or sensation.

The special use of this agent is for the destruction of tape-worms, a wineglassful of the decoction being taken every hour for three hours, to be followed by a purgative dose of castor-oil. The drug itself, in large doses, acts both as an emetic and purgative. The pelletierine tannate, 1 Gm. (or gr. xv) at a dose, in capsules, is an effective, but expensive, remedy. The decoction is so astringent that it may not be possible for the patient to take it, in which case the same result may be obtained by evaporating it, in a water-bath, to a pilular consistency, and administering the extract thus made in gelatin capsules, preceded and followed by a cathartic. Pomegranate has been used with success in the diarrhœa and dysentery of hot climates. Dujardin-Beaumetz has witnessed good results from the employment of pomegranate in Ménière's disease. In paralysis of the third and sixth nerves M. Galezowski asserts that pelletierine is of service.

GRINDELIA (U. S. P.).—**Grindelia.**

Preparation.

Fluidextractum Grindeliæ (U. S. P.).—Fluid Extract of Grindelia. Dose, 0.60 to 4 c.cm. (or *m*x-fʒj).

Pharmacology.—"The leaves and flowering tops of Grindelia robusta and of Grindelia squarrosa (Compositæ)," a perennial California plant, contain a volatile oil, a resin, and, possibly, an alkaloid. The plant possesses a balsamic odor, a warm, aromatic, and bitter taste. The resin is precipitated by water. The active principles are not completely extracted by alcohol, but an aqueous, alkaline solution has been found by Dr. W. P. Gibbons to be the most satisfactory menstruum.

Physiological Action.—Grindelia creates a sensation of warmth in the stomach, and, in small quantities, if not too long continued, improves the appetite and digestion. It slows the action of the heart and lungs, and augments the blood-pressure. It possesses antispasmodic and expectorant qualities. Large quantities dilate the pupil, produce an hypnotic effect, and paralyze first the sensory and then the motor nervous system. Death occurs from paralysis of the muscles of respiration. The plant, however, is but feebly poisonous. It exerts some diuretic effect.

Therapy.—Grindelia is an efficient local application in dermatitis caused by contact with the rhus toxicodendron, or poison-ivy. Cloths dipped in a mixture of 2 to 4 c.cm. (or f℥ss-j) of the fluid extract to 120 to 180 c.cm. (or f℥iv-vj) of water, and laid upon the affected surface, will, in many instances, afford rapid relief. This mixture has also been advantageously employed upon burns and blisters. A combination with creolin is likewise efficient in these conditions:—

Fluidext. grindeliæ	15	c.cm. or f℥ss.
Creolini	7.5	c.cm. or f℥ij.
Aquæ	q. s. ad 150	c.cm. or f℥v.—M.

An injection of the above strength is useful in vaginitis, or, applied upon absorbent cotton, in pruritus vaginæ. It may likewise be resorted to in leucorrhœa and endometritis. A weaker solution thrown into the urethra is of service in gonorrhœa and gleet. Diluted with water or glycerin, the fluid extract of grindelia is a beneficial application to chronic or irritable ulcers, and in these cases it is a good practice to conjoin the internal administration of the remedy. One part of fluid extract to 4 parts of water as a local dressing, together with the internal exhibition of the same preparation, has been found efficient in iritis.

Its fumes may be inhaled for the relief of the paroxysm of asthma, either by smoking in a pipe or saturated in a solution of potassium nitrate, dried and burned upon a plate.

As an internal remedy, the chief value of grindelia is in the treatment of asthma. The paroxysm may usually be notably abridged by the administration of 1.20 to 2 c.cm. (or *m*xx-xxx) of the fluid extract, repeated every twenty or thirty minutes. Two or three such doses will, in many instances, allay the spasm. After the attack has subsided, the medicine should be continued in order to avert recurrence. In the interval grindelia may very profitably be combined with other agents having similar power, as, for example:—

℞ Potassii iodidi	23.3	Gm. or 3vj.
Liq. potassii arsenitis	6	c.cm. or f3iss.
Fluidext. grindeliæ	60	c.cm. or f℥ij.
Tinct. euphorbiæ pilulif.	18.5	c.cm. or f3v.
Fluidext. eriodictyi	q. s. ad 120	c.cm. or f℥iv.

M. et ft. sol.

Sig.: Teaspoonful three times a day. For asthma and chronic bronchitis.

Another efficient combination in asthma is:—

℞ Fluidext. grindeliæ	60	c.cm. or f℥ij.
Potassii iodidi	8	Gm. or 3ij.
Syrup. Tolutan.	q. s. ad 120	c.cm. or f℥iv.

M. et ft. sol.
Sig.: Teaspoonful every three hours.

A formula which has been recommended is:—

℞ Ammonii iodid.	8	Gm. or 3ij.
Fluidext. grindel.		
Fluidext. glycyrrhiz.	aa 15	c.cm. or f℥ss.
Tinct. lobeliæ,		
Tinct. belladonn. fol.	aa 7.5	c.cm. or f3ij.
Syrup. Tolutan.	q. s. ad 120	c.cm. or f℥iv.

M. et ft. sol.
Sig.: Teaspoonful three times a day and additionally during a paroxysm.

Grindelia is eliminated in part by the bronchial mucous membrane, which it stimulates. It is an excellent expectorant in chronic bronchitis, and hence when this condition, as is so often the case, complicates emphysema and asthma, grindelia is no less efficacious than in pure nervous asthma. It relieves cough and promotes expectoration in chronic pneumonia. It is sometimes of advantage in ameliorating the cough of phthisis. In shortness of breath due to anæmia, and in some cases of dyspnœa dependent upon valvular disease of the heart, grindelia has proved beneficial. In certain cases of hay fever this remedy has been used successfully. The paroxysms of whooping-cough are diminished in frequency and mitigated in severity by the administration of grindelia. As it escapes from the system principally by the kidneys, it exerts a favorable influence upon pyelitis and chronic cystitis. The dried leaves may be moistened with nitre solution, and, mixed with a little tobacco, rolled into cigarettes for use in asthma.

GUAIACOL (U. S. P.).—(See under **Creosotum.**)

GUIACOLIS CARBAMAS (U. S. P.).—**Carbamate** of **Guaicol.** (See under **Creosotum.**)

GUAIACUM (U. S. P.).—**Guaiac.**

GUAIACI LIGNUM (B. P.).—**Guaiacum-wood.**

Preparations.

Guaiaci Resina (U. S. P., B. P.).—Guaiac. The resin of the wood of Guaiacum officinale. Dose, 0.32 to 1 Gm. (or gr. v-xv).

Tinctura Guaiaci Ammoniata (U. S. P., B. P.).—Ammoniated Tincture of Guaiac. Dose, 0.60 to 4 c.cm. (or *m*x-f3j).

Tinctura Guaiaci (U. S. P.).—Tincture of Guaiac. Dose, 0.60 to 4 c.cm. (or *m*x-f3j).

Pilulæ Antimonii Compositæ (U. S. P.).—Compound Antimonial Pills (contain guaiac, sulphurated antimony, and calomel).

Mistura Guaiaci (B. P.).—Guaiacum Mixture (guaiac resin, 2 1/2 per cent., with sugar, tragacanth, and cinnamon-water). Dose, 15 to 30 c.cm. (or f℥ss-j).

Trochiscus Guaiaci Resinæ (B. P.).—Lozenge of Guaiac Resin (each containing 0.20 Gm., or gr. iij).

Pharmacology.—The heart-wood of guaiacum officinale (Zygophyllacaæ), or of G. sanctum, enters into one United States Pharmacopœia official preparation of doubtful value, the compound decoction of sarsaparilla,

seldom used at present except as a vehicle for potassium iodide, to cover its unpleasant taste. The resin is the most important constituent of the wood (20 to 25 per cent.), from which it is obtained by heating or by boiling with water. The resin contains **Guaiacetic acid** (10 per cent.), **Guaiaconic acid** (70 per cent.), **Guaiacic acid** (a small quantity), and **Betaguaiac resin** (10 per cent.), with some **Guaiac yellow.** The active principles are insoluble in water, but soluble in alcohol and alkaline fluids.

Physiological Action.—It is esteemed to be alterative and expectorant, but the taste is so unpleasant as to greatly limit its use in medicine. It is a gastro-intestinal irritant, stimulating the liver, and is stated by some to act also on the excretory organs of the skin; and, when it fails to act upon the skin, is diuretic. Dr. Murrell finds it an efficient laxative.

Therapy.—Guaiac was formerly used as an alterative and antisyphilitic, but it is not much valued for this at present,—only as an ingredient in the compound preparation of sarsaparilla, which is used as a vehicle for the iodides. In tonsillitis frequent small doses of the tincture will sometimes cut an attack short.

As a gargle in acute tonsillitis Dr. S. Solis-Cohen makes use of the following preparation:—

℞ Tr. guaiaci ammoniat.	15		c.cm. or f℥ss.
Tr. cinchon. co.	7	5	c.cm. or f℥ij.
Mell. despumat.	22		c.cm. or f℥vj.
Infus. cocæ	60		c.cm. or f℥ij.
Sodii salicylat.	6		Gm. or ℥iss.
Aquæ q. s. ad	180		c.cm. or f℥vj.

M. et ft. sol.

Sig.: A tablespoonful to be used in divided portions and, if advisable, a small quantity may be swallowed.

In various neuralgic and rheumatic affections, in rheumatoid arthritis, in amenorrhœa, and in dysmenorrhœa it is also very useful. In rheumatic sore throat the ammoniated tincture may be administered internally, and added to hot water makes a good gargle.

The following is a formula used by Dr. R. B. Falkner, of Pittsburgh, for a compound guaiac pastille:—

℞ Resinæ guaiacum	13	Gm. or gr. ij.
Morphinæ bimeconat.	00065	Gm. or gr. $^{1}/_{100}$.
Tincturæ aconiti	12	c.cm. or *m*ij.
Ol. cinnamomi	005	c.cm. or *m* $^{1}/_{14}$.
Pulv. cinnamomi	065	Gm. or gr. j.
Pastæ ribes nigri (or black-currant paste)	q. s.	

"The cinnamon disguises absolutely the taste of the guaiac, and, at the same time, adds to the therapeutic efficiency of the pastille. Guaiac, in this combination, is very pleasant, very potent, and very prompt in reducing the inflammatory engorgement in tonsillitis, acute pharyngitis, and in the removal of arthritic throat affections. The peculiar acid of black currants seems to enhance the efficiency of all these forms of pastilles, and the currant-jelly or paste renders the above formula permanently plastic, soluble, and pleasant."

The ammoniated tincture has been given for the purpose of relieving chronic hoarseness dependent upon thickening of the vocal cords.

The compound known in Philadelphia as Zollickofer's mixture is often advantageous in chronic rheumatism. Its composition is:—

℞ Pulv. resin. guaiaci,
Potass. iodid. ..... aa | 65 Gm. or gr. x.
Tinct. colchici sem. ..... 2 | c.cm. or f3ss.
Aq. cinnamomi ..... 15 | c.cm. or f3ss.
Syrupi ..... q. s. ad 30 | c.cm. or f3j.
M. Sig.: From a dessertspoonful to a tablespoonful three times a day.

Good results are sometimes obtained from guaiac in chronic gout, gouty bronchitis, and lumbago.

Dr. Augustus A. Eshner has found the following formula of service in myalgia:—

℞ Tinct. guaiac. ammoniat.,
Fluidext. cimicifugæ
Fluidext. cocæ ..... aa 30 | c.cm. or f3j.
M. Sig.: Teaspoonful before each meal.

In valvular lesions of the heart dependent upon a rheumatic element Dr. A. E. Tussey has prescribed with advantage:—

℞ Resinæ guaiaci,
Digitalis fol.
Quinin. sulph. ..... aa 2 | Gm. or gr. xxx.
Strychnin. sulph. ..... | 065 Gm. or gr. j.
M. et ft. pil. no. xxx.
Sig.: One pill thrice daily.

The ammoniated tincture is regarded as the best preparation; it may be given in milk, in glyceritum vitelli, or in aromatic elixir of licorice. In chronic constipation Murrell[1] has obtained very satisfactory results from the administration of the resin in 0.65 to 1.30 Gm. (or gr. x-xx) doses, in a tablespoonful of thick extract of malt, two or three times daily, according to the case. It occasionally produces a rash. Murrell advises the trial of a triturate with cream of tartar, sugar of milk, or some other inert substance.

Levy asserts that tincture of guaiacum is a valuable remedy in hæmaturia. He gives it in doses of 2 to 4 c.cm. (or f3ss-j) in milk every four hours.

GUARANA (U. S. P.).—Guarana (Pasta Guaranæ).

Preparation.

Fluidextractum Guaranæ (U. S. P.).—Fluid Extract of Guarana. Dose, 0.60 to 4 c.cm. (or *m*x-f3j).

Pharmacology.—"A dried paste prepared from the crushed or pounded seeds of Paullinia cupana (Sapindaceæ)": a climbing plant of Brazil. It is in round masses or cylindrical sticks, resembling chocolate in color and odor. It contains **Guaranine** (5 per cent.), an alkaloid practically identical with **Caffeine**; **tannic acid** (25 per cent.), traces of volatile oil, saponin, etc.

Physiological Action.—The physiological effects are the same as those of coffee or chocolate, but it is of very uncertain strength.

Therapy.—The principal use of guarana is in nervous headache, 2-c.cm. (or f3ss) doses of the fluid extract being administered every hour during the beginning of the attack. It has also been used in diarrhœa. In the headache of chlorosis Dr. Albert Robin, of Paris, often prescribes:—

[1] *Medical Bulletin*, Jan., 1891, "Guaiacum as a Laxative," by William Murrell, M.D., of London, England.

℞ Pulv. guaranæ ..... 20 Gm. or gr. iij.
Ext. cannabis Ind. ..... 01 Gm. or gr. 1/6.
M. et ft. pil. no. j.
Sig.: One such pill to be taken thrice daily.

GURJUN.—Gurjun Balsam or **Oil**, or **Wood-oil**, is an oleoresin obtained from the Dipterocarpus turbinatus and other species of Dipterocarpaceæ of East India. The balsam flows from the wounded tree. It contains from 40 to 70 per cent. of volatile oil, some resin, and **Gurjunic Acid.** It resembles copaiba in physical and physiological properties, but is more acceptable to the digestive organs and has less effect upon the kidneys. Dose, 0.60 to 7.5 c.cm. (or *m*x-f℥ij), in emulsion or capsules, or with extract of malt.

Therapy.—Gurjun-oil is antiseptic and alterative. It likewise exerts a laxative and diuretic influence. In combination with lime-water (1 to 4) it is a useful application in psoriasis and chronic eczema. It has been employed in leprosy, both internally and locally, with asserted curative effect. The oil has been administered successfully in the treatment of gonorrhœa and gleet, also in chronic bronchitis.

GUTTA-PERCHA.—Gutta-percha is the concrete milk juice of Palaquium gutta (Sapotaceæ) : a tree of the East Indies. It is insoluble in water or in alcohol, but soluble in chloroform, oil of turpentine, and carbon disulphide. It softens easily, and can be cut with a hot knife.

Therapy.—Used externally in sheets for making molded splints, as, after softening with hot water, it adapts itself to the surface and soon hardens again. It is also used in making mechanical appliances, such as pessaries, specula, etc. The solution is used as a protective, like collodion.

A solution of 1 part of gutta-percha in 10 parts of chloroform is known by the name of *traumaticin*, or *liquor guttæ perchæ*, and in the treatment of certain cutaneous disorders answers a good purpose as a solvent for various medicaments. The solution constitutes a cleanly application and one which is not too easily removed.

GYNOCARDIA.—Chaulmoogra. The ripe seed of Hydnocarpus Kurzii (Flacourtiaceæ), and perhaps also of Gynocardia Odorata. (See page 324.)

HÆMATOXYLON (U. S. P.), **HÆMATOXYLI LIGNUM** (B. P.).—**Hæmatoxylon (Logwood).**

Preparations.

Extractum Hæmatoxyli (U. S. P.).—Extract of Hæmatoxylon. Dose, 0.32 to 0.65 Gm. (or gr. v-x).

Decoctum Hæmatoxyli (B. P.).—Decoction of Logwood (5 per cent.). Dose, 15 to 60 c.cm. (or f℥ss-ij).

Pharmacology. — Logwood is "the heart-wood of Hæmatoxylon campechianum (Leguminosæ)": a large tree of Central America and the West Indies. It occurs as chips or raspings of a reddish-brown color. Tannin is the principal medical constituent. It also contains **Hæmatoxylin** (12 per cent.), a red coloring constituent resembling licorice in its taste, which is soluble in water and in alcohol.

Physiological Action.—Hæmatoxylon is astringent, tonic, and unirritating. It colors the urine and stools red, and has the disadvantage of staining the linen. It does not produce constipation.

Therapy.—Formerly used as an astringent for children's diarrhœas, but, as the medicine was occasionally spilt or vomited upon the clothing, it was productive of much dissatisfaction, and was abandoned, especially since the new dietetic and antiseptic method has come into vogue. Nevertheless, it is of decided value in tuberculous diarrhœa, and should not be entirely overlooked. The decoction has been used as an astringent in leucorrhœa and bleeding hæmorrhoids.

HAMAMELIDIS CORTEX (B. P.). — **Hamamelis-bark (Witch-hazel Bark).**

HAMAMELIDIS FOLIA (U. S. P., B. P.).—**Hamamelis-leaves.**

Preparations.

Fluidextractum Hamamelidis (U. S. P.).—Fluid Extract of Hamamelis. Dose, 0.60 to 4 c.cm. (or *m*x-f3j).

Extractum Hamamelidis Liquidum (B. P.).—Liquid Extract of Hamamelis. Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Aqua Hamamelidis (U. S. P.).—Hamamelis-water (distilled).

Liquor Hamamelidis (B. P.). — Solution of Hamamelis (distilled from fresh leaves).

Tinctura Hamamelidis (B. P.).—Tincture of Hamamelis (bark, 10 per cent.). Dose, 2 to 4 c.cm. (or f3ss-j).

Unguentum Hamamelidis (B. P.).—Hamamelis Ointment (10 per cent., with lanolin).

Pharmacology.—"The dried leaves of Hamamelis virginiana[1] (Hamamelaceæ) collected in autumn" are official, and, although not stipulated by the pharmacopœia, they should be fresh, as they owe their efficacy largely to some volatile principle not yet isolated; they also contain tannin and a bitter extractive, coloring matter, etc. The British Pharmacopœia directs "the dried bark of Hamamelis virginiana," and "the leaves, fresh and dried, of Hamamelis virginiana." The old leaves and many preparations are devoid of physiological activity, but a well-made fluid extract, and especially the distilled extract, have been found to have decided therapeutical power. The bark of the younger branches is more astringent than the leaves; it contains about 8 per cent. of tannin, and can be used for the same purposes as the leaves. F. Grüttner, after a careful examination of the bark, found fat, gallic acid, tannins consisting of crystalline and amorphous forms of a body having a formula $C_{14}H_{14}O_5$ with a varying amount of water. These bodies, which he calls **Hamamelitanin,** are dextrogyre, possess five hydroxyl groups and one carboxyl, form definite benzoyl derivatives, and hydrolyze to gallic acid. There is also a tannin hydrolyzing to glucose and gallic acid. It also contains glucose. It is probable that the popular distilled extract is made from the leaves and smaller twigs, freshly gathered and treated with dilute alcohol before distillation. Some of the undoubted good results of this agent as a local application, as a wash, a gargle, etc, may be due to the alcohol present.

[1] See papers by the author on "Hamamelis Virginica," read before the British Medical Association, Section of Therapeutics, at Brighton, Aug., 1886—*The Medical Register*, June 4, 1887; "Hamamelis in the Treatment of Diseases of the Skin," read before the Section of Dermatology at the Meeting of German Naturalists and Physicians, held in Berlin, Sept., 1886—*The Medical Bulletin*, Dec., 1886. See also paper on "Hamamelis and Alcohol," by Dr. E. H. Griffin—*Medical Record*, Dec., 1890.

Physiological Action.—Negative physiological results from an investigation of the root have been reported by Wood and Marshall. Dujardin-Beaumetz, on the other hand, believed that witch-hazel owes its utility to an action on the muscular fibres of the veins. Hector Guy[1] reports, after experiments with witch-hazel, that it shows no special physiological action on the vascular system, but that headache sometimes follows full doses.

Therapy.—For sprains, bruises, and superficial inflammations, the distilled extract is à pleasant and valuable application. It is also useful diluted with 2 to 3 parts of water or alcohol in inflammation of the gums, pharyngitis, nasal catarrh after the removal of nasal polypi, in the form of a spray or wash. Either form may be injected into the bladder, properly diluted, in cases of catarrhal inflammation or hæmorrhage. The topical application of hamamelis is much more decidedly hæmostatic than is explained by our present knowledge of its composition. It is a reliable agent in the treatment of capillary hæmorrhage from wounds, epistaxis, bleeding sockets after the extraction of teeth, and in bleeding piles is one of the most efficient agents at our command. This medicament, according to Flagg, is very efficacious in chronic and incurable hæmorrhagic, anæmic, and inflammatory conditions. Leg-ulcers, especially those occasioned by varicose veins, are remarkably benefited by the application of a lotion or ointment containing witch-hazel. This drug possesses a marked sedative as well as astringent action upon congested or inflamed tissues. Hamamelis ointment often, therefore, proves of avail in burns, erysipelas, eczema, and herpes. Excessive secretion is likewise restrained, and for this reason it is sometimes of service in seborrhœa, acne, and rosacea:—

℞ Fluidext. hamamelidis ..... 4| to 6| c.cm. or f℥i-iss.
Zinci oxidi ..... 4| Gm. or 3j.
Amyli ..... 2|60 Gm. or gr. xl.
Glycerini ..... 2| c.cm. or *m*xxx.
Ung. aquæ rosæ ..... 31| Gm. or ℥j.
M. An ointment for sunburn, eczema, intertrigo, etc.

A lotion made from the fluid extract relieves the pain and stiffness of chronic rheumatism. A diluted fluid extract is an efficient lotion in carbuncle, chancroid, freckles, hyperidrosis, and lupus erythematosus. In burns and frost-bites the following combination is useful:—

℞ Liq. plumbi subacetatis,
Tinct. opii ..... aa 30| c.cm. or f℥j.
Aq. hamamelidis ..... 60| c.cm. or f℥ij.
Aquæ ..... 473| c.cm. or Oj.—M.

As an external application to relieve itching in pemphigus vulgaris:—

℞ Creosoti ..... 1| c.cm. or *m*xv.
Liquoris calcis,
Aquæ hamamelidis ..... aa 90| c.cm. or f℥iij.
M. Sig.: For external use.

Fissures of the anus and ulcers of the anus or rectum are improved by the application of a wash or ointment containing witch-hazel.

A 1-per-cent. solution of creosote in decoction of hamamelis with the

[1] *Thèse de Paris*, 1884.

addition of boric acid has been recommended as an excellent injection in gonorrhœa.

Given by the mouth, hamamelis is scarcely less astringent and sedative than when applied externally. It renders good service in cases of acute or chronic diarrhœa, enteritis, and dysentery. It restrains suppuration in pyelitis and reduces the inflammatory congestion of cystitis. In hæmorrhage from internal organs it is an admirable remedy, and may be given with considerable confidence in bleeding from the stomach, bowels, kidneys, womb, or lungs, and in purpura hæmorrhagica. Hamamelis is useful in chronic bronchitis attended by copious discharge. It may be of service in the night-sweats of phthisis. Its internal, conjoined with its external, use is productive of excellent results in epistaxis and varicose ulcers. Varicose veins, varicocele, and internal hæmorrhoids may, not infrequently, be entirely cured by the persistent administration of hamamelis. It has been found serviceable in phlegmasia dolens and often mitigates the pain of dysmenorrhœa. The combined internal and external use of witch-hazel is useful in gonorrhœa after subsidence of the acute stage, and in leucorrhœa. Witch-hazel, also, has the reputation of preventing abortion.

HEDEOMA (U. S. P.).—**Hedeoma (Pennyroyal).**

Preparation.

Oleum Hedeomæ (U. S. P.).—Oil of Hedeoma. Dose, 0.12 to 0.60 c.cm. (or *m*ii-x).

Pharmacology.—"The dried leaves and tops of Hedeoma pulegioides (Labiatæ)" contain an aromatic, volatile oil, which is official, and is its only important constituent.

Physiological Action and Therapy. — Pennyroyal-tea, or a recent infusion of the leaves and tops, is used in flatulent colic and recent suppression of the menses. The oil may be similarly employed, but is very seldom used internally except as a constituent of emmenagogue pills. Dr. Wingate has reported the case of a woman who took a teaspoonful of the oil of pennyroyal with half a teaspoonful of the fluid extract of ergot. In an hour she was unconscious, with small pulse, cold extremities, and slightly-dilated pupils. Several convulsions occurred, and opisthotonos was well marked. Morphine and atropine hypodermically with heat externally proved restorative. Hedeoma is carminative and can be used for flatulence. The oil has stimulant, carminative, and emmenagogic properties.

The fresh herb is said to be obnoxious to mosquitoes, and may be hung about the sleeping room, or the hands and face bathed with a recent infusion or a solution of the oil in alcohol (1 to 10), in order to keep off these midnight marauders. The spirit may be used with an atomizer or as an embrocation for the same purpose.

HELIANTHEMUM.—Frost-wort. The whole herb of the Helianthemum Canadense (Cistaceæ) is a domestic remedy as an alterative and astringent. It contains tannin and some bitter substance. A recent decoction may be used, but a fluid extract made with diluted alcohol (dose, 4 to 7.5 c.cm., or f3i-ij, several times a day) is a better preparation for diarrhœa and dysentery. It is also esteemed useful as a tonic in scrofula and syphilis.

HELIANTHUS ANNUUS.—The **Sunflower,** or Helianthus annuus (Compositæ), is a well-known plant, a native of Peru, but cultivated in many parts

of America and Europe and in China. It is valued chiefly on account of the fixed oil obtained from its seed. The oil possesses nutritive properties and is an excellent illuminating material. Other constituents of the plant are helianthitannic acid, inulin, levulin, a dextrorotatory sugar, and a peculiar oleoresin. In different parts of the world the sunflower is popularly esteemed as a remedy in malaria. M. Moncorvo, of Rio de Janeiro, has reported to the Therapeutical Society of Paris his clinical experiments with sunflower in 100 cases of malaria occurring among children. He found that the plant exerted a decided influence. In sixty-one patients, from one month to twelve years of age, the action of the medicine could be watched for a sufficiently long time, and all the patients recovered as rapidly as if they had taken quinine. M. Moncorvo used the tincture and an alcoholic extract and seems to prefer the former preparation. The drug was nearly always well tolerated in the dose of 2 c.cm. to 9.25 c.cm. (or f℥ss-iiss) of the tincture, administered in a potion every two hours and taken in four or five doses. The alcoholic extract was given in the dose of 1 to 6 Gm. (or gr. xv-℥iss).

HELLEBORUS.—The Christmas rose, black hellebore, Helleborus niger (Ranunculaceæ), is a native of Central and Southern Europe, and is cultivated in England and the United States for its showy flowers. The rhizome with rootlets is the part used. The most important constituents are two glucosides,—**Helleborin** and **Helleborein,**—both crystalline, which are cardiac and nervous poisons. There is no tannin.

Physiological Action.—The taste is bitter and acrid; the freshly bruised drug, but not the dried preparation, has a somewhat rancid odor. The dust is irritating and causes violent sneezing. Internally the effects are emetic, drastic, cathartic, and emmenagogic. In its action upon the heart it resembles digitalis. Venturini and Gasparini have ascertained that solutions of helleborein, dropped into the conjunctival sac of rabbits and dogs, produce, within fifteen minutes, such complete anæsthesia that the cornea can be penetrated without causing pain. At the same time, the sensibility of other parts of the eye and its appendages is left intact. The anæsthesia is of longer duration than that due to cocaine. No alteration of the pupil or the intra-ocular pressure is produced.

Therapy. — Rarely used at present, except as an ingredient in some proprietary emmenagogic pills. (For American helebore, see **Veratrum,** U. S. P.). Helleborein, which is soluble in water, has been experimentally employed in doses from 0.006 to 0.015 Gm. (or gr. $^1/_{10}$-$^1/_4$) as a substitute for digitalis.

HELONIAS.—Helonias, False Unicorn. The Chamælirium luteum (Gray) or Helonias dioica (Pursh), belonging to the natural order, Melanthaceæ, is a native of North America, east of the Mississippi. The root is the portion used, and, from its resemblance to a horn, is called unicorn-root. It contains a bitter principle, **Chamælirin.** A fluid extract is made with the aid of alcohol, of which the dose is 1.20 to 2 c.cm. (or *m*xx-xxx). It is reported to be tonic and anthelmintic.

HEMIDESMI RADIX (B. P.).—**Hemidesmus-root.**

Preparation.

Syrupus Hemidesmi (B. P.).—Syrup of Hemidesmus (10 per cent.). Dose, 2 to 4 c.cm. (or f℥ss-j).

Pharmacology and Therapy.—The dried root of Hemidesmus indicus (Asclepiadaceæ), commonly known as Indian Sarsaparilla, or Nunnari, contains a volatilizable active principle: **hemidesmic acid.** It has tonic, diuretic, diaphoretic, and alterative properties; and is also used for the same purposes as sarsaparilla, usually as a decoction (62 Gm. to 437 c.cm., or ℥ii-Oj). The official syrup is a more pleasant preparation.

HEPATICA.—Hepatica, Liverwort.

Pharmacology and Therapy.—The Hepatica triloba (Ranunculaceæ) is a native of North America. Its leaves contain mucilage and tannin; a recent infusion of them, taken hot, is useful in the early stage of bronchitis. The fluid extract may be employed as a demulcent astringent in diarrhœa. Dose, 2 to 6 c.cm. (or f℥ss-iss), in fluid extract.

HEROINÆ HYDROCHLORIDUM.—Heroine Hydrochloride [$C_{17}H_{17}(C_2H_3O_2)_2NOHCl$]. Heroine is an artificial alkaloid, diacetyl-morphine, which is almost insoluble in water, but its combination with hydrochloric acid, as heroine hydrochloride, is very soluble, and is preferable for medical use. Experiments upon animals show heroine to be less toxic than morphine or codeine, which it resembles in physiological effect, especially as a sedative for cough. Doses of 0.0025 to 0.005 Gm. (or gr. $^1/_{24}$-$^1/_{12}$) will usually quickly relieve the cough of acute bronchitis. Dr. John North found it especially valuable in pneumonia, relieving dyspnœa and cough, reducing temperature and pulse, and favoring sleep, in doses of 0.005 Gm. (or gr. $^1/_{12}$) at night.

As regards the safety of this agent, it appears that the statements as to its entire freedom from depressing action upon the heart cannot be relied upon. Dr. A. L. Russell, of Midway, Pa., in a recent communication to the *Pennsylvania Medical Journal*,[1] reported two cases of sudden and alarming attacks of heart-weakness during the administration of small doses (0.005 Gm., or gr. $^1/_{12}$). One case, male, 24 years of age, after taking this dose three times a day for several days, "fell over on his face while at table in a spasm of dyspnœa, with marked cyanosis."

Dreser recommended a dose of from 0.005 to 0.01 Gm. (or gr. $^1/_{12}$-$^1/_6$), but Leo[2] has seen unpleasant results, such as giddiness, nausea, and once even fainting, after 0.01 Gm. (or gr. $^1/_6$). The narcotic action of heroine is much less than that of either morphine or codeine. Thus, in sciatica, trigeminal neuralgia, cardialgia, including the pain due to gastric ulcer and muscular rheumatism, it either did not relieve the pain or did so only momentarily. Leo found its action exceptionally satisfactory in the various forms of dyspnœa. It increased the duration of inspiration and the amount of air taken in. In hay fever, the internal administration of heroine hydrochloride in small doses, 0.002 Gm. (or gr. $^1/_{30}$) every two or four hours, conjoined with treatment locally with applications of suprarenal-gland extract, has been found useful by Abrams, of Hartford, and others. Leo employed it in 2 cases of uræmic dyspnœa, 8 cases of marked emphysema, 15 cases of chronic bronchitis without obvious emphysema, and 5 cases of bronchial asthma. Only in 1 case of emphysema and 2 of chronic bronchitis was no good effect noted. Its action was almost magical in some cases. After one or two doses

[1] September, 1900, p. 200.

[2] *Deutsche medicinische Wochenschrift*, March 23, 1899.

the patients were able to sleep in the recumbent posture. When the drug was discontinued, in emphysema and chronic bronchitis, the symptoms mostly returned, but in many cases there was an interval of from eight to fourteen days. Sometimes the expectoration became more difficult after the use of heroine and for this the author combined it with potassium iodide.

Eulenberg[1] used a 2-per-cent. solution of heroine hydrochloride for subcutaneous injection, the single dose being from 0.24 to 0.50 c.cm. (or *miv-viij*) of this solution, or 0.005 to 0.01 Gm. (or gr. $^1/_{12}$-$^1/_6$) of the salt. Thus, the doses of heroine are less than those of morphine. Only on two occasions did he use more than the above-named doses. Once he injected 0.02 Gm. (or gr. $^1/_3$) in a patient accustomed to morphine, and once 0.012 Gm. (or gr. $^1/_5$) in a woman with sciatica. In both cases unpleasant symptoms arose; thus, in only exceptional cases should 0.01 Gm. (or gr. $^1/_6$) be given in a single dose, and it should only be very gradually increased. The action of heroine in allaying cough and in diminishing attacks of asthma and dyspnœa is more rapid when given by subcutaneous injection than by the mouth. Eulenburg thinks that it possesses a more marked narcotic and antineuralgic action than is accredited it by Leo. He has found it of special value in those long accustomed to the use of morphine. It may be of service, as a temporary substitute, in cases of the morphine habit. The hydrochloride of heroine can also be given by the mouth, and here the single dose should not exceed 0.005 to 0.01 Gm. (or gr. $^1/_{12}$-$^1/_6$). The usual dose to begin with should not be more than 0.0025 Gm. (or gr. $^1/_{24}$), which may be added to cough mixtures, or given in glycerin. In tuberculous laryngitis, it may be applied locally, as well as administered internally. Arthur Strauss, of Barmen, Prussia, claims that heroine has an anaphrodisiac effect, when given in doses of 0.01 Gm. (or gr. $^1/_6$) each evening. George E. Petty, of Memphis, Tenn., warns against forming a heroine addiction, which he finds is as hard to overcome as the morphine habit itself. The antidotes to toxic doses are coffee, and arterial stimulants, as in opium poisoning.

HEUCHERA.—Heuchera, Alum-root. The Heuchera Americana belongs to the Saxifragaceæ, and is a native of the United States. The root contains considerable tannin (18 to 20 per cent.), and an infusion or fluid extract is useful as a mouth-wash, gargle, etc., or may be given for diarrhœa.

HEXAMETHYLENAMINA (U. S. P.).—**Hexamethylenamine (Urotropin, Formin, etc.).**

HEXAMETHYLEN TETRAMIN.—This agent is formed chemically by the union of ammonia with formaldehyde. It is an unstable compound, and may be decomposed by a feeble acid, or even by the sodium acid phosphate, present in the urine, liberating formaldehyde, which again combines with the sodium salts present in the urine, as the characteristic odor is not manifest. In medicinal doses it causes no digestive disturbance and only a moderate increase of urine. It is necessary, while treating a patient with urotropin, that the urine should be kept acid, otherwise the decomposition will not occur and the disinfectant action of the formaldehyde not obtained.

In genito-urinary therapeutics urotropin is of value, especially in the medical treatment of the diseases of the urinary passages. Thus, in

[1] *Deutsche medicinische Wochenschrift*, March 23, 1899.

pyelitis, in cystitis with ammoniacal urine, and in chronic inflammation of the deep urethra. The average daily dose is 1 to 2 Gm. (or gr. xv-xxx), or 0.32 Gm. (or gr. v) four times daily. This treatment has also been found efficient in phosphaturia, the urine clearing up almost immediately after the remedy was taken. Nicolaier claims that it will even dissolve uric-acid concretions.

The drug, though of undoubted value, is not quite so free from injurious effects as has been thought. Dr. W. Langdon Brown[1] reports two cases of hæmaturia following the use of 0.65 Gm. (or gr. x) of urotropin three times a day, both patients recovering after discontinuance of the drug. Dr. T. J. L. Forbes also reported an interesting case of hæmaturia due to urotropin in a male, aged 62 years, suffering from cystitis of about ten days' duration. The urine contained pus, but no blood, and was ammoniacal; there was enlargement of the prostate; the patient was given 0.65 Gm. (or gr. x) of urotropin thrice daily in half a pint of warm water. Two days later the patient expressed himself as feeling better, and the urine was much improved; on the evening of the third day there was increased difficulty in micturition, a burning feeling in the urethra, abdominal pains, with diarrhœa, and marked hæmaturia; the urine was not scanty. The urotropin was withdrawn, and in five days, all traces of blood having disappeared, he was again given 0.32 Gm. (or gr. v) of the drug, and, after taking 1 Gm. (or gr. xv), felt a return of the burning sensation in the urethra and again passed a little blood in the last quantity of his urine.

Albuminuria may follow the ingestion of urotropin, as in a case cited by Dr. A. Griffith, in which the albumin disappeared on the third day after withdrawal of the drug.

HIRUDO (B. P.).—**Leeches.**

The speckled leech, Sanguisuga medicinalis, and the green leech, Sanguisuga officinalis, are recognized by the British Pharmacopœia. The animal of either variety is two or more inches in length, worm-like, having a soft, smooth body. The American leech, Hirudo decora, is an inferior animal, and does not withdraw as much blood as the other varieties. (For further considerations see **Leeches**, Part II.

HOLOCAIN is a synthetic product closely allied to phenacetin, and in its action resembles cocaine. It is formed by the combination of molecular equivalents of phenacetin and para-phenetidin with the separation of water, the product being fine, crystals of para-di-eth-oxy-ethenyl-amidin. It is basic in action and insoluble in water. The hydrochlorate, which is the salt generally used, dissolves in boiling water, but on cooling deposits all but $2\,^1/_2$ per cent. It is perfectly neutral and will keep for months without change. It should be boiled in porcelain, as the hot solution attacks glass. In 1-per-cent. solutions it rapidly produces anæsthesia of the cornea without altering the pupil, or intra-ocular pressure, or the corneal epithelium. Dr. Hermann Knapp claims that it is superior to cocaine, as it has a very beneficial action on septic ulcers of the cornea. Dr. Hasket Derby considers it of especial value in corneal ulceration on account of its bactericidal action.[2]

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[1] *British Medical Journal*, June 15, 1901.

[2] *Archives of Ophthalmology*, vol. xxviii, No. 1, 1899.

HOMATROPINÆ HYDROBROMIDUM (U. S. P., B. P.).—**Homatropine Hydrobromide.**

Dose, 0.0008 to 0.003 Gm. (or gr. $^1/_{18}$-$^1/_{20}$).

Preparation.

Lamellæ Homatropinæ (B. P.).—Discs of Homatropine (each contains 0.00065 Gm., or gr. $^1/_{100}$, of homatropine hydrobromide).

Pharmacology and Therapy.—"The hydrobromide ($C_{16}H_{21}NO_3HBr$), of an alkaloid prepared from tropine," is a reliable mydriatic for examination and determination of refraction in ophthalmological practice, having the advantage over other mydriatics in being prompt in its action, but more transitory in its effects, which pass away in from thirty-six to forty-eight hours, while those of hyoscyamine last eight or nine days and those of atropine continue for ten or twelve days. The ordinary solution for paralyzing the accommodation is of the strength of 1 per cent., in distilled water, a few drops of which are instilled into the eye every five or ten minutes until the full effect is obtained. Some hyperæmia of the conjunctiva generally follows its use, but not true inflammation, unless under very exceptional circumstances.

It is less irritant than atropine and much less apt to occasion systemic intoxication. The only evidence of constitutional action usually observed is a moderate retardation of the pulse.

Dr. Pooley has recorded the case of a girl 7 years of age, in whom intellectual, sensorial, and motor disturbances followed the instillation of a 2-per-cent. solution of homatropine every fifteen minutes for an hour. Several days elapsed before the patient recovered her usual health.

In the treatment of choroiditis, and other disorders for which a mydriatic is used, atropine is more suitable because its action is more prolonged, and it causes less hyperæmia.

In making homatropine solutions, the water should be boiled just before using, and small quantities only made at a time, as distilled water, unless recently boiled, usually contains bacteria and other germs derived from the air, which might induce irritation.

Homatropine hydrochloride and *salicylate* are salts which have a similar action to the hydrobromide, the dose of each being from 0.0005 to 0.003 Gm. (or gr. $^1/_{120}$-$^1/_{20}$). Besides the mydriatic properties already referred to, these salts have likewise been used in checking night-sweats, especially of phthisis.

HUMULUS (U. S. P.), **LUPULUS** (B. P.).—**Hops.**

Preparations.

Lupulinum (U. S. P., B. P.).—Lupulin. (The glandular powder separated from the strobiles.) Dose, 0.13 to 0.32 Gm. (or gr. ii-v).

Fluidextractum Lupulini (U. S. P.).—Fluid Extract of Lupulin. (Contains lupulin 1 Gm. in each c.cm.) Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Oleoresina Lupulini (U. S. P.).—Oleoresin of Lupulin. Dose, 0.12 to 0.30 c.cm. (or *m*ii-v).

Infusum Lupuli (B. P.).—Infusion of Hops, Hop-tea (5 per cent.). Dose, 30 to 60 c.cm. (or f℥i-ij).

Tinctura Humuli.—Tincture of Hops (20 per cent.). Dose, 2 to 4 c.cm. (or f℥ss-j).

Tinctura Lupuli (B. P.).—Tincture of Hops (20 per cent.). Dose, 2 to 4 c.cm. (or f3ss-j).

Pharmacology.—Hops are "the carefully dried strobiles of Humulus lupulus (Urticaceæ), bearing their natural glandular indumentum." The official definition of lupulin is "the glandular trichomes separated from the fruit of Humulus lupulus." The constituents are bitter **Lupamaric**, or hop-bitter acid, and lupulotannic acid, besides nearly 1 per cent. of volatile oil, 9 to 18 per cent. resin, and 3 to 4 per cent. tannin, etc. Hops likewise contain a fermentable sugar, diastase, and a small quantity of asparagin. The fluid extract of lupulin is made with alcohol; the oleoresin is extracted with ether; both are eligible preparations.

Physiological Action.—The preparations of hops are stomachic, tonic, hypnotic, slightly diaphoretic, and anaphrodisiac. Although usually devoid of any local irritant effect, Dr. John W. Eckfeldt has met with several cases of severe and prolonged dermatitis caused by the vapor produced in making a hop poultice. He ascribes the effects to the volatilization of the oil of hops with its subsequent condensation upon the skin.[1]

Therapy.—Malt liquors, containing hops, are largely used as aids to the appetite and digestion; unfortunately, many of them contain a very small proportion of hops, the deficiency being made up with aloes or other bitter substances, with cocculus Indicus, grains of paradise, glycerin, soap, salicylic acid, etc., which detract from their value both from a medicinal and a commercial stand-point. A well-made beer of good quality, however, is a useful preparation of hops, and has considerable medicinal value as a tonic during convalescence, or in feeble digestion, or as a stimulant to the appetite and nutrition. The sedative effect of the hops is assisted by the alcohol and carbonic acid, making beer useful in gastric catarrh with gastralgia and as an hypnotic in neurasthenia with insomnia. In this condition a hop-pillow is appropriately used. Though not of much efficacy in itself, yet it assists in producing a narcotic effect. Beer may be given when all other forms of nourishment are refused, as in diphtheria; and eggs or beef-powder may be added to it to increase its value. The tincture of hops, or the fluid extract of lupulin, are also alcoholic, but in them the proportion of alcohol is so considerable as to make it the chief constituent. Malt liquors increase the flow of milk during lactation.

The sedative effects of hops are obtained from a hop-poultice in local painful affections, or the hops may be placed in flannel and moistened with hot whisky and applied to painful areas, as in toothache or earache, where the warmth and steam are very soothing.

The inhalations of the vapor of hops are often attended with good results, especially in diseases of the throat and chest. Lefferts used with benefit this combination:—

℞ Sodii carbonatis exsiccati	1|30	Gm. or gr. xx.
Aquæ ferv. (140°)	473|	c.cm. or Oj.
Solve et adde:—		
Extracti humuli	4|	Gm. or 3j.

M. The vapor to be inhaled.

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[1] "On the Poisonous Action of Hops." By John W. Eckfeldt, M.D., *Medical Bulletin*, Jan., 1892.

In delirium tremens hop-tea, with a quantity of Cayenne pepper, quiets drink-craving and settles the stomach. In hysteria and nervousness preparations of hops are useful medicaments. Hops—especially when employed in the form of the infusion or tincture—are often most efficacious for their hypnotic action in insomnia and restlessness. The following formulæ are useful combinations:—

℞ Tinct. humuli ..... 90 | c.cm. or fʒiij.
Tinct. capsici ..... 7 | 5 c.cm. or fʒij.
Glycerini ..... 60 | c.cm. or fʒij.
M. Sig.: A tablespoonful every hour or two for nervousness.

℞ Tinct. humuli,
Tinct. ammon. valerianatis,
Spiritus ætheris nitrosi ..... aa 60 | c.cm. or fʒij.
M. Sig.: Two teaspoonfuls in water every hour or two. Use in insomnia, hysteria, and nervousness.

In irritation of the genito-urinary passages full doses of the oleoresin of lupulin afford much relief, and it has also been used as an anaphrodisiac in priapism, chordee, spermatorrhœa, and similar affections. A very suitable prescription in genito-urinary irritation, of service in the diseases just referred to, is:—

℞ Lupulini,
Camphoræ monobromatæ ..... aa 4 | Gm. or 3j.
Ol. theobromatis ..... q. s.
M. et ft. suppositoriæ no. xij.
Sig.: Insert one into the bowel every three or four hours.

HYDRANGEA.—Hydrangea. The dried root of Hydrangea arborescens (Saxifragaceæ) has long been used by the aborigines, in the South, in the form of a decoction, in the treatment of calculous affections. A fluid extract, made with diluted alcohol, is a convenient form in which to administer the remedy in doses of 2 to 4 c.cm. (or fʒss-j). It is of especial utility in gravel and renal colic.

HYDRARGYRUM (U. S. P., B. P.).—**Mercury, Quicksilver.**
"It should be 99.9 per cent. pure, and be kept in strong bottles."

U. S. P. Preparations.

Hydrargyrum cum Cretâ.—Mercury with Chalk, Gray Powder (mercury, 38 Gm.; clarified honey, 10 Gm.; prepared chalk, 57 Gm.; water, to make 100). Dose, 0.03 to 0.65 Gm. (or gr. ss-x).

Hydrargyri Chloridum Corrosivum.—Corrosive Mercuric Chloride, Corrosive Chloride of Mercury, Corrosive Sublimate. Dose, 0.002 to 0.006 Gm. (or gr. $^1/_{30}$-$^1/_{10}$).

Hydrargyri Chloridum Mite.—Mild Mercurous Chloride, Calomel, Mild Chloride of Mercury. Dose, 0.003 to 0.65 Gm. (or gr. $^1/_{20}$-x).

Hydrargyri Iodidum Flavum.—Yellow Mercurous Iodide, Protiodide, Yellow (or green) Iodide of Mercury. Dose, 0.02 Gm. (or gr. $^1/_3$).

Hydrargyri Iodidum Rubrum.—Red Mercuric Iodide, Biniodide. Dose, 0.00125 to 0.006 Gm. (or gr. $^1/_{50}$-$^1/_{10}$).

Hydrargyri Oxidum Flavum.—Yellow Mercuric Oxide. For external use.

Hydrargyri Oxidum Rubrum.—Red Mercuric Oxide, Red Precipitate. Dose, 0.0012 to 0.006 Gm. (or gr. $^1/_{50}$-$^1/_{10}$).

Hydrargyrum Ammoniatum.—Ammoniated Mercury, White Precipitate. For external use.

Massa Hydrargyri.—Mass of Mercury, Blue Mass, Blue Pill (mercury, 33 per cent., with althæa, licorice, glycerin, and honey of rose; a 3-grain blue pill contains 1 grain of mercury). Dose, 0.03 to 0.75 Gm. (or gr. ss-xij).

Emplastrum Hydrargyri.—Mercurial Plaster (mercury, 30 Gm.; oleate of mercury, 1.2 Gm.; lead plaster, q. s. to make 100 Gm.).

Emplastrum Ammoniaci cum Hydrargyro.—Ammoniac Plaster with Mercury (contains mercury, 18 Gm.; and ammoniac, 72 Gm., with oleate of mercury, diluted acetic acid, and lead plaster).

Liquor Arseni et Hydrargyri Iodidi.—Solution of Arsenic and Mercuric Iodide, Donovan's Solution (1 per cent. each arsenic iodide and red mercuric iodide). Dose, 0.06 to 0.60 c.cm. (or *m*i-x).

Liquor Hydrargyri Nitratis.—Solution of Mercuric Nitrate (contains red mercuric oxide, 40 Gm.; nitric acid, 45 Gm.; distilled water, 15 Gm.).

Oleatum Hydrargyri.—Oleate of Mercury (yellow mercuric oxide, 25 Gm.; oleic acid, 75 Gm.).

Unguentum Hydrargyri.—Mercurial, or Blue, Ointment (mercury, 50 per cent., triturated with lard, suet, and oleate of mercury).

Unguentum Hydrargyri Dilutum.—Diluted with 33 per cent. of petrolatum.

Unguentum Hydrargyri Ammoniati.—Ointment of Ammoniated Mercury (ammoniated mercury, 10 Gm.; benzoinated lard, 90 Gm.).

Unguentum Hydrargyri Nitratis.— Ointment of Mercuric Nitrate, Citrine Ointment (mercury, 7 Gm.; nitric acid, 17.5 Gm.; lard, 76 Gm.).

Unguentum Hydrargyri Oxidi Flavi.—Ointment of Yellow Mercuric Oxide (10 per cent.).

Unguentum Hydrargyri Oxidi Rubri.—Ointment of Red Mercuric Oxide (10 per cent.).

B. P. Preparations.

Hydrargyrum cum Cretâ.—Mercury with Chalk, Gray Powder (mercury, 20 Gm.; prepared chalk, 40 Gm.). Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Hydrargyri Perchloridum.—Mercuric Chloride, Bichloride of Mercury, Corrosive Sublimate. Dose, 0.002 to 0.004 Gm. (or gr. $^1/_{32}$-$^1/_{16}$).

Hydrargyri Subchloridum. — Mercurous Chloride, Calomel, Hydrargyri Chloridum. Dose, 0.03 to 0.32 Gm. (or gr. ss-v).

Hydrargyri Iodidum Rubrum.—Mercuric Iodide, Biniodide of Mercury. Dose, 0.002 to 0.004 Gm. (or gr. $^1/_{32}$-$^1/_{16}$).

Hydrargyri Oxidum Flavum.—Yellow Mercuric Oxide. For external use.

Hydrargyri Oxidum Rubrum.—Red Mercuric Oxide. Dose, 0.0012 to 0.006 Gm. (or gr. $^1/_{50}$-$^1/_{10}$).

Hydrargyrum Ammoniatum.—Ammoniated Mercury, Ammonio-chloride of Mercury, White Precipitate. For external use.

Hydrargyri Oleas.—Mercuric Oleate (mercuric chloride, 32 Gm.; hard soap, powdered, 64 Gm.; oleic acid, 4 c.cm.; distilled water, boiling, q. s.).

Pilula Hydrargyri.—Mercury Pill, Blue Pill (mercury, 40 Gm.; with confection of roses and licorice-root). Dose, 0.25 to 0.5 Gm. (or gr. iv-viij).

Emplastrum Hydrargyri.—Mercurial Plaster (mercury, 82 Gm.; olive-oil, 3.5 Gm.; sublimed sulphur, 0.5 Gm.; lead plaster, 164 Gm.).

Emplastrum Ammoniaci cum Hydrargyro.—Ammoniacum and Mercury Plaster (ammoniacum, 328 Gm.; mercury, 82 Gm.; olive-oil, 3.5 Gm.; sublimed sulphur, 0.5 Gm.).

Liquor Arsenii et Hydrargyri Iodidi. — Solution of Arsenious and Mercuric Iodides (1 per cent. each of arsenic iodide and mercuric iodide). Dose, 0.30 to 1.20 c.cm. (or *m*v-xx).

Liquor Hydrargyri Nitratis Acidus.—Acid Solution of Mercuric Nitrate.

Liquor Hydrargyri Perchloridi.—Solution of Mercuric Chloride (1 Gm., or gr. xv, to make 875 c.cm., or f℥xxx). Dose, 2 to 4 c.cm. (or f℥ss-j).

Lotio Hydrargyri Flava.—Yellow Wash (corrosive sublimate, 0.46 Gm., or gr. vij; in solution of lime, 100 c.cm., or f℥xxvij). For external use.

Lotio Hydrargyri Nigra.—Black Mercurial Lotion, Black Wash (calomel, 0.685 Gm., or gr. xj, with glycerin and mucilage of tragacanth and solution of lime, q. s. 100 c.cm., or f℥xxvij).

Linimentum Hydrargyri.—Liniment of Mercury (ointment of mercury, 30 Gm.; strong solution of ammonia, 10 c.cm.; liniment of camphor, q. s. ad 90 c.cm.).

Pilula Hydrargyri Subchloridi Composita.—Compound Pill of Mercurous Chloride, Compound Calomel Pill, Plummer's Pill (contains calomel, 25; sulphurated antimony, 25; guaiacum resin, 50; castor-oil, 10.3; alcohol, 3 c.cm. or q. s.). Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Unguentum Hydrargyri.—Mercury Ointment (mercury and lard, each, 160 Gm.; prepared suet, 10 Gm.).

Unguentum Hydrargyri Ammoniati.—Ammoniated-Mercury Ointment, White-Precipitate Ointment (ammoniated mercury, 30 Gm.; paraffin ointment, 270 Gm.).

Unguentum Hydrargyri Nitratis. — Mercuric-Nitrate Ointment (mercury, 100 Gm.; nitric acid, 300 c.cm.; lard, 400 Gm.; olive-oil, 700 Gm.).

Unguentum Hydrargyri Nitratis Dilutum.—Diluted Mercuric-Nitrate Ointment (20 per cent. mercuric-nitrate ointment, with paraffin).

Unguentum Hydrargyri Compositum.—Compound Mercury Ointment (mercury ointment, 150; bees-wax, 90; olive-oil, 90; camphor, 45).

Unguentum Hydrargyri Iodidi Rubri.—Mercuric-Iodide Ointment (4 per cent.).

Unguentum Hydrargyri Oleatis.—Mercuric-Oleate Ointment (1 to 3).

Unguentum Hydrargyri Oxidi Flavi.—Yellow Mercuric-Oxide Ointment (yellow mercuric oxide, 0.5 Gm.; soft paraffin, 24.5 Gm.).

Unguentum Hydrargyri Oxidi Rubri.—Red Mercuric-Oxide Ointment, Red-Precipitate Ointment (red mercuric oxide, 10 Gm.; paraffin ointment, 90 Gm.).

Unguentum Hydrargyri Subchloridi.—Mercurous-Chloride Ointment, Calomel Ointment (10 per cent. of mercurous chloride).

Triturations can be made with any mercurial and sugar of milk, usually in decimal proportions.

Pharmacology. — Commercial mercury is always impure, being combined with tin, antimony, zinc, and other metals. It can be purified by treating it with dilute nitric acid, and afterward washing it free from the acid with water. In the pure state, it is a shining, silver-white metal, liquid at common temperatures, and having the specific gravity of 13.5. The chlorides are the salts of the greatest medical importance. They are made by double decomposition; thus, mercuric sulphate and sodium chloride are triturated together and heat applied, when the mercuric (or corrosive) chloride sublimes in the form of white crystalline masses or powder; in order to form the mercurous chloride (calomel), an additional proportion of mercuric sulphate is added before subliming. Owing to the tendency to combine with other metals, the presence of mercury may be ascertained by half-immersing a gold piece in a suspected solution, when the mercury will be deposited as a gray or silver coating, if present. Reinsch's test and the reduction test may be employed as in testing for arsenic, when the small globules of mercury may be detected upon the glass, which are as easily recognized with the microscope as the crystals of arsenic.

In accordance with the chemical theory of Mialhe, it is usually taught that calomel is converted within the body into corrosive sublimate by the agency of sodium chloride. As a result of careful experiments, Dr. Paul Adams finds that, although this change may take place in the air, the access of air is practically excluded from the alimentary tract and that but a trace of calomel passes into solution. This is the case even in the presence of organic matter, and he arrives at the conclusion that sodium chloride is not incompatible with calomel. For the same reason it had generally been held that muriatic or nitromuriatic acid should not be given in conjunction with the mild chloride.

Toxic Action and Antidotes.—The salts of mercury are very poisonous to all lower forms of life, and mercurial solutions form our most convenient and useful antiseptics. Applied to the skin in concentrated form, most of

them are irritating, and some are destructive, to the tissues. They easily diffuse through the integument, and may in this way cause systemic effects, even from the solutions employed for antiseptic purposes, but especially from contact with mercurial ointment or fumigations. Various forms of paralysis are produced by the influence of this metal, especially among workmen who are habitually exposed to its vapors. Mercury has a marked influence upon the nervous system, causing debility with tremors. The nervous disorder is often accompanied by a brownish discoloration and a dryness of the skin. Symptoms simulating those of chronic lead poisoning, including wrist-drop, have resulted from prolonged mercurial inunction. Nerves of special sensation may be affected. Neuralgia, epilepsy, and insanity may also occur.

Upon the salivary glands, mercurials have very stimulating effects. The salivary secretions may be increased to several pints daily, the fluid at first being albuminous and thick, but subsequently becoming thin and watery. The irritation may cause inflammation, and ulceration or sloughing of the mouth or cheek may result, especially where the patient is in poor physical condition or suffers with some cachexia, or is exceptionally susceptible to the action of mercury. The condition of the general system accompanying the action of the mercurial upon the salivary glands and mouth is known as "ptyalism," or salivation. A febrile movement of low type usually accompanies these manifestations. It has been found by Dr. Petersen that disease of the kidney establishes a predisposition to the occurrence of ptyalism. For this reason, when the gums of a syphilitic patient become affected, the urine should at once be examined.

Mercury also affects the digestive organs, causing diarrhœa and a fetid breath; if continued a sufficient length of time, emaciation also occurs. These symptoms, taken collectively, constitute **Hydrargism**, or **Mercurial Cachexia**, or **Erethism**, which might be mistaken for malignant disease, especially if accompanied by some enlargement of the liver.

A bright- or dark- red rash sometimes occurs upon the skin while mercury is being taken. The discoloration may be attended by itching and may be followed by desquamation. An eruption resembling that of small-pox has been observed as a consequence of the use of a $^1/_2$-per-cent. sublimate solution as a vaginal wash conjoined with the application of a mercurial ointment to the abdomen. Cases have been observed in which mercury caused generalized dermatitis, with swelling, desquamation, subcutaneous infiltration, fever, and prostration. This form of intoxication may even have a fatal termination.

Pure metallic mercury is not poisonous, and passes through the alimentary tract unchanged, acting as a mechanical laxative. Acute poisoning by corrosive sublimate occurs when a toxic dose has been swallowed. The symptoms are immediate and violent: these are vomiting; purging, at first serous, afterward bloody; burning pain in the stomach and œsophagus, suppression of urine, face swollen and bloated, with much prostration of the bodily powers, etc. Severe and even fatal intoxication may take place from absorption through an abraded surface. Dr. Sackur has reported a case in which death occurred in consequence of absorption of mercurial ointment through some trivial fissures of the skin.

Albumin is the antidote to corrosive sublimate; eggs and milk should be freely swallowed, the stomach washed out with a stomach-pump, arterial stimulants administered, hypodermic injections of morphine and whisky

given, and external heat applied. After the first symptoms are over, the patient is liable to perish from ulceration or stricture of the œsophagus, destruction of the peptic glands in the stomach, salivation, and exhaustion.

Ptyalism is best treated by mouth-washes containing potassium chlorate and tincture of myrrh, and by tonics and small doses of belladonna, or atropine with morphine. The gums may become inflamed, soft, and bleeding, and the teeth loose, but under this treatment the inflammation subsides and the teeth again become firm. Salivation was of such common occurrence when mercury was given freely that it was looked upon as salutary, and it was thought necessary to "touch the gum" in order to obtain therapeutic results from the remedy; but this idea no longer prevails, and patients are no longer fully salivated intentionally, this part of the so-called antiphlogistic treatment having fallen into disuse.

Physiological Effects.—The action of mercury upon the liver has occasioned much controversy. The corrosive chloride in small doses is an hepatic stimulant and cholagogue; but this action has been denied to calomel, which acts principally upon the excretory glands in the lower part of the small intestine and colon. It is not yet known, however, in what form calomel enters the blood, but it is possible that a soluble combination is formed with albumin and hydrochloric acid; it is even possible that part of it may be changed into corrosive chloride, in which case some action upon the liver would naturally follow. Whatever ingenious explanation the laboratory may have to offer with regard to the cholagogic action of the mercurials, and calomel especially, clinical medicine has already settled the fact that where the tongue is heavily coated and the conjunctivæ slightly jaundiced, the skin sallow, and the liver inactive, with clay-colored stools, it can all be set right with a few small doses of calomel, and bilious stools be produced.

Salivation is a reflex phenomenon and depends upon a primary mercurial stomatitis. Both these effects are much more decided when the drug is administered by inunction. Ricord found perfectly healthy salivary glands in a ptyalized patient who died of an intercurrent disease. In administering mercury it is important that the mouth be kept in good condition. The presence of carious teeth, for instance, is often the starting-point of a stomatitis. P. Diday has reported a case in which this accident was transferred by kissing from man to wife, and believes that we may admit that certain of the numerous microbes which inhabit the mouth become virulent under the influence of the mercurial impression.

The diuretic action of mercury has of late years attracted considerable attention. It has been found that mercury, and more especially calomel and blue pill, have the power of decidedly promoting the action of diuretics. Boem[1] claims that the absorption of mercury salicylate, which is incomplete, is, however, greater than that of calomel. It is stated, as the result of some investigations by F. Klemperer,[2] that, in rabbits, corrosive sublimate injected into the blood was eliminated by the intestinal glands and kidneys. In acute cases there was congestion of the kidneys, with extravasations, and, if prolonged, the parenchyma showed signs of inflammation, with a deposit of chalk in the straight tubules; while, in the dog, there occurred fatty degeneration instead of chalky deposit. According to the studies of Calantoni, if death is not caused within ten hours, necrosis of the renal epithelium

[1] *British Medical Journal.*
[2] *Therapeutic Gazette*, Oct. 15, 1890, p. 693.

occurs. Intestinal lesions are chiefly present in the colon, and consist of hyperæmia, hæmorrhage, and necrosis. No apparent relation exists between the severity of the renal and intestinal lesions. In a monograph on the action of mercury on the kidneys Dr. Karvonen[1] gives an account of his experiments on rabbits and dogs, various mercurial preparations having been administered subcutaneously, and the kidneys afterward examined microscopically. In all cases changes were detected in these organs, varying from simple hyperæmia to marked nephritis with albuminuria and tube-casts. The well-known deposits of lime-salts in the kidney were often obtained as a result of the action of mercury. From his own experience the author describes similar symptoms occurring in man. He also mentions the occasional occurrence of glycosuria.

It is evident that mercury in small doses is capable of acting as a stimulant to the kidneys, and this agrees with the observations of Jendrassik upon the use of calomel as a diuretic. Small quantities of mercurials, therefore, are useful additions to squill, digitalis, and other diuretic remedies.

The fact has been established that small doses of corrosive sublimate (0.0006 Gm., or gr. $^1/_{100}$, three times daily) favor physiological functions and stimulate the blood-making glands. These constitute the so-called "tonic doses" of mercury.

The metal is slowly eliminated in the urine and glands of the digestive tract. It has been detected in most of the tissues and secretions of the body. The bone-marrow may retain it for a long period, and it may be found in metallic globules in the cancellated tissue of bones long after death. When death results from mercury, diphtheroidal, hæmorrhagic inflammation of the large intestine is found.

The external, as well as internal, use of mercury may occasion local paralysis, as in a case narrated by Dr. A. W. Foot, in which there was loss of power in the muscles of the hand and forearm after rubbing cattle with an ointment containing the red iodide.

Therapy.—1. *Local Application, or External Use.*—A most important field of usefulness for mercurials, at present, is in antiseptic surgery. The solutions have the advantage of convenience, being easily made and cheap, odorless and permanent. The field of operation, having been well soaped and shaved and washed with ether, is usually irrigated with a solution of corrosive sublimate (1 to 2000, or 1 to 4000 and much weaker if the skin is broken). For washing out wound-cavities, or the peritoneum, still weaker solutions should be made use of (1 to 6000 or 10,000). In lying-in hospitals, or where the surroundings are decidedly unhygienic, and also where symptoms of septic infection are manifested after delivery, the danger may be averted by the free use of these mercurial antiseptic vaginal douches several times a day. In modern surgery much attention is given to the proper disinfection of the hands. Abbott[2] states that of the numerous methods two are thoroughly trustworthy, viz.: that of Fürbringer and that of Welch, developed at the Johns Hopkins Hospital. Fürbringer's method: 1. Remove all dirt under and around nails. 2. Brush nails and skin of hands thoroughly with soap and hot water. 3. Immerse in alcohol, 95 per cent., for not less than a minute, and before this evaporates (4) plunge the hands in

[1] *British Medical Journal*, June 11, 1899.

[2] "Hygiene of Transmissible Diseases," 1899.

1 to 500 corrosive-sublimate or 3-per-cent. carbolic-acid solution, and thoroughly wash them for at least a minute, after which the hands may be rinsed in warm water and dried. Welch's method: 1. The hands and nails are to be thoroughly cleansed with hot water and soap. The water is to be as hot as can be borne, and the brush used is to have been sterilized with steam, this preliminary brushing to occupy from three to five minutes. 2. The hands are then rinsed in clean, warm water. 3. They are then immersed for one or two minutes in a warm, saturated solution of potassium permanganate. While in this solution they are rubbed thoroughly with a sterilized swab of absorbent cotton. 4. They are then placed in a warm, saturated solution of oxalic acid, and kept there until completely decolorized. 5. They are then thoroughly washed in clean, sterilized water or salt solution. 6. Finally, they are immersed for two minutes in 1 to 500 corrosive-sublimate solution, rinsed in water, and dried.

The use of corrosive-sublimate injections during and after parturition has caused a remarkable reduction of the death-rate in lying-in hospitals.

A mercurial solution has also been used to irrigate the uterus in puerperal septicæmia, but the practice is not without the danger of giving rise to poisoning by absorption.

In 1880, Koch demonstrated that bichloride of mercury (sublimate) was the most powerful of antiseptics. It was found that in a solution of 1 to 1000 it would soon destroy the spores of anthrax: the most virulent of all germs. This was true with regard to non-albuminous media, but when the medium to be disinfected contained albumin, the mercury coagulated the albumin, formed an albuminate of mercury, which deposited, leaving the supernatant liquid practically free from mercury, and, hence, without antiseptic power. Dr. Ernest Laplace,[1] in Koch's laboratory, seeking a method to prevent this coagulation, and, therefore, to retain for the mercury its same disinfecting power in albuminous as in non-albuminous fluids, found that an addition of a small quantity of any acid to the ordinary solution would fulfill this purpose. Accordingly, the acid sublimate solution consists of:—

Mercuric sublimate	1 part.
Hydrochloric acid (pure)	5 parts.
Water	q. s. ad 1000 parts.

Hydrochloric acid is used preferably to all others. When, however, the acid sublimate must be carried in a solid form, tartaric acid is substituted for the hydrochloric acid.

Mercuric sublimate	1 part.
Tartaric acid	5 parts.

To be made into a tablet, which must be dissolved in 1000 parts of water.

This form was adopted by the Academy of Medicine of Paris, to be used by midwives throughout France. The acid sublimate is the only disinfectant used in Koch's laboratory. It is also used in the Pasteur Institute of Paris. Besides being the surest and most powerful antiseptic, it is the only solution of mercury that will always retain its integrity, and never form a deposit of earthy salts. It is used for all manner of disinfection, except that

[1] *Deutsche medicinische Wochenschrift*, No. 40, 1887.

of instruments. In a solution as weak as 1 to 50,000 it retains sufficient power to destroy the germs of suppuration.

Dr. A. C. Abbott enjoins caution in the use of corrosive sublimate upon open wounds, for the reason that the albumin of the parts tends to counteract its influence and that it materially injures the integrity of the tissues, impairing the normal resistance of the solids and fluids of the body to the attacks of micro-organisms. As a result of many experiments, he finds that, under favorable conditions, only a certain number of the pathogenetic microbes are destroyed by the mercurial, and that, though the remainder may be temporarily attenuated, the effect disappears by successive cultivation in normal media.

The biniodide (1 to 4000 or 1 in 20,000) is recommended by Miquel, and Panas prefers it in eye surgery, it being less irritating than corrosive sublimate. It might also be added that there is much less danger of a mercurial impression being made upon the system by absorption where this salt is used, as the solutions usually only contain half as much mercurial.

The biniodide of mercury is not very soluble in water, but its solution may be promoted by the addition of alcohol or of an equal quantity of potassium iodide.

In ear affections, an ointment of yellow mercuric oxide, 0.32 to 0.65 Gm. to 31 Gm. (or gr. v-x to ℥j) of lard or cold cream, is much used to relieve inflammation and keep the canal clean.

In a case where a mass of molten lead had run into the ear, filling the tympanum, Mr. A. Marmaduke Sheild[1] succeeded in removing the impaction by filling the external meatus with liquid mercury, which seemed to have a solvent action upon the lead. After remaining undisturbed in the ear for sixteen hours the mercury escaped, mingled with lead, and on the following day the latter metal was so softened that it could be easily removed.

An ointment of yellow oxide has been used in eye practice in the treatment of chronic blepharitis, tinea tarsi, and eczema, or by rubbing in at night a largely-diluted citrine ointment. The irritant properties of the red oxide render its ointment a useful application to indolent ulcers, whether of syphilitic or common origin; to enlarged scrofulous glands, or goitre, rosacea, scleroderma, and lepra. The oleate is a milder and a safer application, though less efficient. The yellow wash is a good application in scrofulous conjunctivitis. Finely-powdered calomel may be dusted over the surface of the lids in phlyctenular ophthalmia and corneal ulcerations. The subconjunctival injection of a 1 to 1000 solution of corrosive sublimate was originally practiced by Darier, 0.12 c.cm. (or *m*ij) being introduced, and very favorable results have been reported by Dr. Adolf Alt, of St. Louis,[2] from the use of this method in iritis, iridochoroiditis, exudative choroiditis, central chorioretinitis, and detachment of the retina. The cases of iritis were of all varieties, including those of syphilitic, rheumatic, and traumatic origins. In the treatment of corneal troubles, however, especially parenchymatous keratitis, this writer observed no beneficial action. A certain number of cases of sympathetic ophthalmia have also been reported as cured by this method of treatment. It is regarded, however, as unadapted to cases in which the stasis of the local circulation prevents, either wholly or in part,

[1] *Lancet*, April 30, 1892.

[2] *American Journal of Ophthalmology*, Feb., 1894.

absorption of the injected fluid. Mercuric cyanide has been employed instead of the corrosive sublimate.

In granular conjunctivitis, the following ointment is beneficial:—

℞ Hydrarg. oxid. flav. ..... 20 Gm. or gr. iij.
Zinci oxidi,
Thymol.,
Cocain. hydrochlorid..... aa 10 Gm. or gr. iss.
Camphor. ..... 03 Gm. or gr. ss.
Petrolati albæ..... 23 3 Gm. or ℥vj.

M. Sig.: Apply locally.

℞ Hydrargyri oxidi flav. ..... 38 Gm. or gr. vj.
Camphoræ ..... 20 Gm. or gr. iij.
Ungt. aquæ rosæ,
Adipis lanæ hyd..... aa 8 Gm. or ℥ij.

M. For irritable and inflamed eyelids.

Before applying calomel to the eye, the physician should always ask whether or not the patient has been upon an iodine course, since a caustic compound may form between the mercury and iodine and give rise to intense pain, with inflammatory swelling of the conjunctiva and lids. Cases have occurred in which this unfortunate accident has led to almost complete loss of vision.

The ointment of the red oxide, properly diluted, is a valuable resolvent in enlarged glands, goitre, and ague-cake, the application being made in the direct rays of the sun, or before a fire. This ointment may also be serviceably applied to indolent ulcers, seborrhœa, and lupus erythematosus. Ulcers, especially venereal, are stimulated by the application of diluted acid nitrate of mercury (1 to 10 or 20), but this preparation often gives rise to pain and hæmorrhage, and should be used very cautiously upon soft parts for fear of causing sloughing. It should never be used for venereal ulcers in full strength. A better method is to wash the sores, or condylomata, with solution of chlorinated soda, and, after drying with absorbent cotton, dust calomel, or equal parts of calomel and starch, over the surface, as practiced by Ricord. The black wash also makes a good dressing in such cases and in rhus poisoning. In acne or eczema of the scalp, lotions containing 1 or 2 parts per thousand, or, in infants, 1 in 10,000 of corrosive sublimate, are much used.

Corrosive sublimate in the form of an ointment or lotion, $^1/_2$ to 1 per cent. (or gr. ii-v to ℥j), is employed successfully for the removal of freckles.

Calomel alone, or combined thus, is of service in herpes and irritation around the genital organs:—

℞ Hydrargyri chloridi mitis ..... 12 Gm. or ℥iij.
Bismuth. subnit.,
Pulv. lycopodii ..... aa 15 5 Gm. or ℥ss.

M. Sig.: Dust over the surface.

Calomel is also of much value, dusted over the surface, to diminish exuberant granulations, as follows:—

℞ Hydrargyri chloridi mitis,
Iodoformi ..... aa 15 5 Gm. or ℥ss.

M. Sig.: Sprinkle over the ulcer or ulcerated surface.

Dr. J. B. James, of London, claims good results from the application of calomel to hæmorrhoids, especially when the tumor is inflamed.

Calomel likewise forms an ingredient of many cancer powders for destroying malignant growths upon and in the skin. Esmarch's painless powder contains calomel, and is composed as follows:—

℞ Hydrargyri chloridi mitis	5	20 Gm. or gr. lxxx.
Arsenii trioxidi Morphinæ hydrochloridi	aa	65 Gm. or gr. x.
Pulveris acaciæ	31	Gm. or ʒj.—M.

For acne we may use the following:—

℞ Hydrarg. chloridi corrosivi		38 Gm. or gr. vj.
Mist. amygdalæ	180	c.cm. or fʒvj.

M. Sig.: Apply night and morning.

Stronger solutions are useful in scabies, tinea versicolor, ringworm, and alopecia:—

℞ Hydrargyri chloridi corrosivi		75 Gm. or gr. xij.
Spiritus thymoli	7	5 c.cm. or fʒij.
Aquæ hamamelidis	150	c.cm. or fʒv.—M.

℞ Hydrargyri chloridi corrosivi		65 Gm. or gr. x.
Spiritus rosmarini	30	c.cm. or fʒj.
Ammonii chloridi	2	Gm. or ʒss.
Spiritus vini rectificat.	120	c.cm. or fʒiv.—M.

Mercurials are frequently used for their local effects upon mucous membranes; for instance, in syphilitic ulceration of the tongue, lozenges of licorice containing 0.002 Gm. (or gr. $^1/_{30}$) of corrosive sublimate may be allowed to dissolve slowly in the mouth, and the solution, being swallowed, also produces its constitutional effects. In disease of the uterus and pelvic organs, Dr. A. L. Smith, of Montreal, uses cotton and wool tampons containing mercuric chloride, 0.006 Gm. (or gr. $^1/_{10}$), in conjunction with boroglyceride solution (10 per cent.), introduced into the vagina twice a week. Several cases have been placed on record of corrosive sublimate poisoning from a vaginal douche (1 to 2000). This method of treatment is too dangerous to be carried out by the patient herself; the ordinary corrosive sublimate tablets are for surgical and obstetric use, and should only be employed by the physician, since the danger of poisoning is too great to allow them to lie around the house, within the reach of children. Lamentable accidents have occurred through neglect of this precaution.

In acute follicular tonsillitis, good results have been reported by A. Sbrocchi,[1] by local treatment with corrosive sublimate. A solution (1 to 1000) is applied carefully by means of a cotton-wool sponge, to the whole surface of the inflamed gland; but without wounding the mucous membrane. The soft palate and uvula should also be brushed with the solution. The sittings should be repeated at intervals of 3 or 4 hours. This treatment does not avail for diphtheria. When four paintings fail to effect improvement, he resorts to antitoxin.

Red precipitate ointment has been used for the anointing of chapped lips, the treatment of sores and cracks at mouth-corners, and for the cure of fissured lips. By distending the fissures and filling them repeatedly with the ointment—*distending the fissure* with each insertion of ointment—a

[1] *Medical Bulletin*, January, 1906.

quality of cicatricial tissue is produced which, by its toughening, almost always prevents any subsequent fissuring.

Dr. Marshall employed a 5-per-cent. solution of the oxide of mercury in oleic acid, adding one-eighth part of ether, for sycosis and parasitic and itching affections. The oleates are useful where induration exists. The official oleate (25 per cent. of mercuric oxide) is preferable to blue ointment in the inunction treatment of syphilis, being more elegant and cleanly, and equally efficient. This preparation is of decided value in old patches of psoriasis and chronic eczema of the palms or soles. The mercuric oleate exerts a powerful resolvent influence upon enlarged glands and upon a thickened, indurated condition of the integument. It is, likewise, curative in animal and vegetable parasitic affections.

In the treatment of eczema capitis, or impetiginoides, in infants, much benefit is derived from removal of crusts with sweet oil, followed by compresses wet with bichloride (1 to 10,000); and with due attention to general health and the diet.

In the treatment of favus, Kinsh holds that there is nothing better than persistent and repeated epilation, with brisk rubbing of a watery solution of corrosive sublimate (0.005 to 0.008 Gm., or gr. $^1/_{12}$-$^1/_8$) into the diseased surface. This, however, should not be intrusted to the patient, who will either underdo or overdo it, but he may apply some other antiparasitic ointment, or antipruritic. Of the former may be mentioned mercurial and sulphur ointments, of the latter those containing tar, carbolic acid, creosote, etc.

In the varieties of trichophytosis and in phtheiriasis a diluted ointment of the nitrate is often valuable. It is beneficial, also, in chronic eczema, psoriasis, rosacea, sycosis, and in numerous chronic disorders of the skin.

The following formulæ, containing one of the mercurial ointments, may be employed in the diseases referred to above:—

℞ Ungt. hydrargyri ammoniat. ..... 15|5 Gm. or ʒss.
Olei lavandulæ florum..... 1|20 c.cm. or *m*xx.
Ungt. zinci oleatis ..... 15|5 Gm. or ʒss.

M. Use in acne, rosacea, and chronic eczema.

℞ Ungt. hydrargyri nitratis ..... 15|5 Gm. or ʒss.
Olei juniperi ..... 2| to 7|5 c.cm. or f3ss vel f3ij.
Adipis lanæ..... 15|5 Gm. or ʒss.

M. For chronic psoriasis and eczema, especially of the hands and feet.

℞ Ungt. hydrargyri oleatis (20 per cent.) ..... 31| Gm. or ʒj.
Thymolis iodidi..... 4| Gm. or 3j.

M. Serviceable in animal and vegetable parasitic diseases.

℞ Ungt. hydrargyri ammoniat. ..... 31| Gm. or ʒj.
Mentholi,
Cocainæ hydrochloridi..... aa |65 Gm. or gr. x.
Ol. caryophylli ..... |60 c.cm. or *m*x.

M. Beneficial in herpes, herpes zoster, seborrhœa, and eczema, especially of the genital organs.

An ointment of calomel (1.30 to 31 Gm., or gr. xx-ʒj, of lard) is also serviceable in similar cases, and Metchnikoff has found it to prevent the infection of syphilis, if rubbed on the spot inoculated within one hour after infection. A weak calomel ointment is of service in impetigo contagiosa and ecthyma. The latter stage of dermatitis is also benefited by the use of this unguent.

In gonorrhœa or urethritis, either acute or chronic, irrigation of the urethra with weak solutions of corrosive sublimate (1 to 10,000), used every four hours, is sometimes followed by rapid cure. A little tartaric acid should be added to the solution to keep the mercury from becoming changed into an albuminate. In gonorrhœa and gleet, the injection of a solution of mercury salicylate ($^1/_4$ to 1 per cent.) may rapidly remove the discharge. Mercurial inunction or the subcutaneous injection of corrosive sublimate is recommended as of advantage in gonorrhœal rheumatism.

The application of mercurial ointment is a popular treatment for pubic pediculosis. A case is reported by Wightnick, in which a patient salivated himself by the free use of the remedy (nearly two ounces in three days).[1]

Professor Guyon, of Paris, introduced the practice of injecting a solution of corrosive sublimate into the bladder for the relief of tuberculous cystitis, and excellent results have been reported as obtained by the adoption of this method.

In affections of the joints, orchitis, enlarged glands, an ointment containing 0.065 to 0.13 Gm. (or gr. i-ij) of morphine and 4 Gm. (or ʒj) of calomel in 31 Gm. (or ℥j) is very useful in reducing the swelling and averting threatened abscess. By the use of the Vigo plaster, compression may be made around a joint or a swollen testicle with great benefit. An ointment of sublimate (0.13 to 0.20 to 31 Gm., or gr. ii-iii to ℥j) is also useful in the ulcerated stage of lupus vulgaris. The official blue ointment is useful in erysipelas as a local application, allays inflammation in paronychia, and is a good dressing in chilblains and dermatitis. The solution of mercuric nitrate, much diluted (1 to 20, or more) is serviceably applied to warts, chancroids, syphilitic condylomata, mucous patches, and ulcers of the mouth. It should not be used carelessly or salivation may ensue, or local sloughing.

Miller[2] claims to have cured 15 out of 17 cases of hydrocele by drawing off the fluid aseptically and immediately returning through the cannula, 1 c.cm. (or *m*xv) of water, containing 0.002 Gm. (or gr. $^1/_{32}$) of corrosive sublimate, and leaving it in the hydrocele-sac. There is very little pain, but, if complaint be made, he advises application of belladonna ointment.

2. *Internal Administration.*—Since fermentation is now known to play an important part in disorders of digestion, it is to be expected that the antiseptic powers of mercury would make it conspicuously useful in treating digestive disorders. When there is a foul stomach, coated tongue, some vertigo or headache, constipation, and depression of spirits,—what is commonly called a bilious attack,—0.65 to 0.75 Gm. (or gr. x-xij) of blue mass or calomel, followed in from six to eight hours by a saline purgative, will entirely change the state of affairs. It is probably true that these doses are larger than necessary, but, as the excess is carried away by the saline, no harm is done. In some cases much smaller quantities given in broken doses —say, 0.006 Gm. (or gr. $^1/_{10}$) of calomel with a little soda, given each hour until five doses are taken—is sufficient to produce the same effect if followed by a cathartic. If there is much engorgement of the liver, larger doses are preferable, and we may use with advantage the old "ten and ten" (10 grains, or 0.65 Gm., each of calomel and jalap). During the first week of typhoid fever, two or three full doses of calomel are useful in cleaning the alimentary

[1] *Lancet*, Sept. 9, 1905.
[2] *Lancet*, Sept. 4, 1897.

canal and making it to some degree aseptic. This is a part of the so-called specific treatment of typhoid.

The corrosive chloride has likewise been used in the treatment of enteric fever, and Loranchet reports that in twenty-one cases, where this salt was the principal remedy, it caused decided amelioration of severe symptoms and apparent abatement of the toxic manifestations.

Digestive disorders in infancy are very frequent, and often are promptly controlled by mercurials. Mercury with chalk is a common ingredient in teething-powders, but should not be used freely unless the infant suffers with congenital syphilis; for, although children are not easily salivated, yet they may be affected by the mercurial, as is shown by the peculiarity in the shape of the permanent teeth due to malformation, the result of the incautious use of teething-powders containing mercury. Calomel is used for the same purpose, as well as the corrosive chloride, both of which are particularly useful in mucous diarrhœa, or enterocolitis, in small or minute doses, given every hour, suspended or dissolved in recently-boiled water. In strumous children, with poor digestion, small appetite, and irregular bowels, the following is a valuable tonic:—

℞ Hydrarg. chlor. corrosivi	.032	Gm. or gr. ss.
Tr. gentianæ compositæ	150	c.cm. or f℥v.
Syr. aurantii	30	c.cm. or f℥j.

M. Sig.: A teaspoonful four times daily, at meal-times.

In vomiting of adults and infants, 0.0006 Gm. (or gr. $^1/_{100}$) of corrosive sublimate, or minute doses of calomel with soda, or saccharated pepsin, will often check the irritability of the stomach, if the diet be properly restricted. In vomiting infants, it may be necessary to stop the use of milk for a few days, and rely altogether upon rice-water or albumin-water until the digestion is normal again. The vomiting of cholera infantum is often relieved by small doses of calomel, and the nausea of adults frequently yields to the same treatment. A minute dose of calomel, or corrosive sublimate, administered at hourly intervals, is advantageous in acute or chronic dysentery, soon causing the disappearance of blood and mucus from the discharges. The corrosive chloride, in doses of 0.001 to 0.002 Gm. (or gr. $^1/_{60}$-$^1/_{30}$) before each meal, promotes cicatrization of a gastric ulcer. The occasional use of a mercurial purge aids in expelling intestinal worms, and, in fact, calomel is an efficient remedy against tape-worm. Given in full cathartic dose, mercury also is an excellent anthelmintic in case of lumbricoid worms. It is a common and good practice to use a mercurial in combination with santonin.

Mercury is no longer regarded as essential in the treatment of all forms of inflammation of internal organs, but small doses are valuable in promoting the absorption of inflammatory exudations, especially in glandular affections, in orchitis, in croupous pneumonia or broncho-pneumonia, tonsillitis, and meningitis.

Calomel is of special value in limiting or promoting the absorption of inflammatory exudations of serous membranes. It is also efficacious in iritis.

Wallace Beatty points out its value[1] especially in case of venous engorgement, due to chronic pulmonary or mitral valve disease, or dependent on mitral incompetence, or from failure of the right heart caused by emphysema

[1] *Dublin Journal of Medical Science*, Oct., 1899.

and bronchial and cardiac dilatation due to chronic interstitial nephritis. Also in cases of dilatation with general dropsy, without obvious valvular disease. He finds the method most successful in his hands, of administering mercury, to be with small doses frequently repeated, for its diuretic effects. The plan he adopts is to give a pill containing 0.03 Gm. (or gr. ss) of calomel, usually with digitalis or squills, every four hours, night and day, for ten to fourteen days. In case they produce purgation, he changes the pills to one with opium, 0.008 to 0.03 Gm. (or gr. $^1/_8$-ss), instead of the digitalis. He usually gives two sets of pills to be employed according to the circumstances. The mercury acts by stimulating the renal secretions and increasing the activity of absorption at the same time. He does not pretend to say that it is useful in all cases, but, when digitalis and other cardiac tonics fail, the use of mercury is often attended with the happiest results.

In ascites caused by disease of the liver, Palma obtained excellent results from the administration of calomel. The urine was greatly increased in quantity and the transudation correspondingly diminished.

In a case of hypertrophic cirrhosis of the liver, Sior observed disappearance of the jaundice and marked reduction in the size of the liver and spleen in consequence of the use of calomel. In cases of hydatid cyst of the liver Baccelli advises that after about 30 c.cm. (or f℥j) of the fluid has been withdrawn a corrosive-sublimate solution should be injected into the sac. Twenty c.cm. (or f℥vss) of a 1 to 1000 solution are used in this manner, and, at the end of five days, the parasite is dead and the symptoms steadily improve.

In the treatment of diphtheria, Dr. Daly,[1] of Pittsburgh, strongly advocated Reiter's method of using calomel, 0.13 to 0.32 Gm. (or gr. ii-v) being given every hour, or every two or three hours, to young children, until the discharges from the bowels appear as colorless serum, with a little greenish mucus or bile upon the surface resembling chopped spinach. Then the interval is lengthened, but the same dose continued. Shorts[2] gives from 0.32 to 1 Gm. (or gr. v-xv) every two or three hours to an adult until the greenish stools are obtained, avoiding salivation by the simultaneous administration of 0.32 to 0.50 Gm. (or gr. v-viij) of potassium chlorate. The corrosive chloride has also its advocates in this disease, and here the system tolerates comparatively large doses, not only with impunity, but with benefit. From 0.0015 to 0.006 Gm. (or gr. $^1/_{40}$-$^1/_{10}$) may be given every two hours to an infant for twenty-four to forty-eight hours, until the worst part of the illness has passed over, when the interval can be lengthened and the dose reduced. This has the advantage of being less likely to cause salivation than the calomel. In true membranous or diphtheritic croup, this plan of treatment may avert the necessity of intubation or tracheotomy. Rennert, however, has used with very satisfactory results, in diphtheria, an application to the throat of Laplace's tartaric-acid, corrosive-sublimate solution, in the strength of 1 to 500. His statements have been corroborated by Dr. M. Graham Tull, of Philadelphia. In whooping-cough, Raubitschek reports favorably on the local employment of a 1 to 1000 solution of corrosive sublimate, applied upon a cotton tampon and pressed against the base of the tongue and swabbing the tonsils, uvula, and soft palate. The procedure was repeated every day or every second day with the result of materially modifying and abridging the

[1] "Transactions of American Laryngological Association," 1886.

[2] *Physician and Surgeon*, Sept., 1889; "Annual of the Universal Medical Sciences," 1890.

course of the disease. In diphtheria, Dr. E. L. B. Godfrey uses iron in combination with corrosive mercuric chloride:—

℞ Hydrargyri chloridi corrosivi		065 Gm. or gr. j.
Tinct. ferri chloridi	7	5 c.cm. or f3ij.
Syrup. simplicis	22	c.cm. or f3vj.
Aquæ	q. s. ad 90	c.cm. or f3iij.

M. Sig.: A teaspoonful in water every three hours.

The yellow, mercuric subsulphate is a valuable adjunct in the treatment, for 0.13 to 0.20 Gm. (or gr. ii-iij) administered to a child are followed by prompt emesis and the ejection of false membrane from the throat. Fordyce Barker considered it uniformly successful in croup. It should not be allowed to remain in the stomach in case the first dose does not produce vomiting, as it may cause gastritis or mercurial poisoning; it generally is rejected too rapidly for absorption to take place.

In other constitutional diseases attended by inflammation of the throat, we may give 0.02 Gm. (or gr. $^1/_3$) of gray powder three or four times a day, as recommended by Ringer. This high authority also advises the same preparation in the same dose, given hourly, in acute tonsillitis when the swollen glands interfere with deglutition and respiration. In troublesome ulcerations of the throat, corrosive-sublimate solution is often beneficial as a local application, accompanied by other treatment suitable to the case. In diphtheria, the best results are obtained by antitoxin, and the internal administration of mercurials, conjoined with local disinfection by salt-water douches, potassium permanganate, trypsin, toluol, or boroglyceride, instead of local applications of mercurials, since where they are frequently used it is impossible to estimate how much has been swallowed.

The appended formulæ containing mercury will be of benefit in diphtheria, acute tonsillitis, and often in acute laryngitis:—

℞ Hydrargyri chloridi mitis		13 Gm. or gr. ij.
Antimonii et potassii tart.		065 Gm. or gr. j.
Sacchari albi	2	Gm. or 3ss.

M. et ft. chartulæ no. x.
Sig.: A powder every hour or two.

℞ Hydrargyri chloridi corrosivi		065 Gm. or gr. j.
Tinct. guaiaci	30	c.cm. or f5j.
Glycerini	60	c.cm. or f3ij.

M. Sig.: A half to one teaspoonful every two or three hours.

The sore throat of scarlatina is benefited by the administration of the gray powder, or the corrosive chloride. Petresco, after numerous bacteriological and clinical experiments, relies upon Van Swieten's solution[1] in the treatment of measles, scarlet fever, and small-pox. In scarlet fever the solution of the corrosive chloride was applied directly to the throat, either by penciling or in the form of a gargle.[2]

Mapother,[3] in the treatment of psoriasis, employs mercury externally

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[1] Van Swieten's solution is composed as follows: 0.65 Gm. (or gr. x) each of corrosive sublimate and ammonium chloride, dissolved in a pint of distilled water. Dose, 2 to 4 c.cm. (or f3ss-j).

[2] "Récherches Cliniques et Expérimentales sur l'Antisepsie Médicale," par le Dr. Z. Petresco. Memoire présenté au Congrès de Thérapeutique à Paris en 1889. Jassy: Imprimerie National, 1889.

[3] "The Parasitic Nature of Psoriasis, its Treatment by Mercury," by E. D. Mapother, M.D., F.R.C.S., in *British Medical Journal*, Jan. 17, 1891.

and internally, the blue pill or the protiodide of mercury being usually prescribed. The writer has employed the mercurials, especially the corrosive chloride hypodermically, in the treatment of several cases of psoriasis, with a complete removal of all the eruption from the body, the dose and injection used being similar to that already described in treating syphilis. Poncel, of the Marseilles Hospital, has also employed injections of the corrosive chloride of mercury into tumors of a cancerous appearance, followed by their complete disappearance. Dr. R. Cowan Lees, of Glasgow, reports that he has met with some success in the treatment of sarcomata and carcinomata by injections of corrosive sublimate dissolved in olive-oil. He employs the same method in pneumonic phthisis.

A case of traumatic tetanus in a child has been described by Celli, in which success followed the hypodermic injection of corrosive sublimate, as first practiced by Baculo. During seven days, nine injections of about 0.005 Gm. (or gr. $^1/_{12}$) were given. Improvement was observed from the beginning, and on the eighth day the patient was completely cured. Schwab has used for congenital syphilis, the following, hypodermically:—

℞ Hydrargyri biniodidi	0.05	Gm. or gr. $^5/_6$.
Sodii iodidi	0.05	Gm. or gr. $^5/_6$.
Aquæ destillatæ	10	c.cm. or ʒij$^1/_2$.

M. Sig.: Dose for an infant, 0.10 c.cm. (containing 1 mg., or gr. $^1/_{64}$).

The ointment of the nitrate, very much diluted, also mercurial ointment, has long been used upon the face in small-pox in order to prevent the development of the pocks and consequent pitting. The effect probably is dependent both upon the mercury and the exclusion of light and air.

For the local treatment of variolous pustules, Dr. Talamon advises spraying the surface with a solution containing 1 Gm. (or gr. xv) each of corrosive sublimate and citric or tartaric acid, 5 c.cm. (or *m*lxxv) of 90° alcohol, and a sufficient quantity of sulphuric ether to make 90 c.cm. (or fʒiij). He makes use of the same method in the treatment of erysipelas. Dr. H. A. Ingalls,[1] of Cincinnati, reports a series of 36 cases of small-pox, 1 of which was hæmorrhagic and 13 confluent, treated without mortality, as a result of the use of baths of bichloride of mercury (1 to 10,000) given twice daily. A large bath-tub was brought to the side of the patient's bed and filled with a warm (103° to 105° F.) solution of bichloride, and the patient immersed, except the head and shoulders, for about ten or twelve minutes, the nurse gently rubbing the entire body with a soft cloth during the bath. After the bath the patient was anointed with a mixture of carbolic acid, bismuth subnitrate, and olive-oil. Dr. Ingalls reports the following observation of this treatment: 1. There is practically no mortality. 2. The suppurative fever can be shortened four to six days, if patient is treated from the onset. 3. A minimum of pitting is secured and an almost entire absence of the characteristic disagreeable odor. 4. The period of desquamation is materially lessened owing to the thinness of the scab-formation. 5. Pain is very much reduced, morphine being rarely required. 6. The great distortion of features, which gives us such repulsive-looking patients, is eliminated to a great extent. On local treatment of erysipelas, Prof. Roswell Park, of Buffalo, said: "Of all the numerous applications which I have ever tried, I

[1] *Journal of the American Medical Association*, April 28, 1900, p. 1044.

have found but one thing which has given the universal satisfaction afforded by the following prescription or something equivalent to it: Resorcin (or naphtalin), 5; ichthyol, 5; mercurial ointment, 40; lanolin, 50. The proportions of these ingredients may be varied, and I often increase the amount of ichthyol, especially when the skin to which it is to be applied is not too tender. The affected parts are anointed with this, and then covered with oiled silk or some impermeable material, simply to prevent its absorption by the dressings; the parts are then enveloped in a light dressing and bandaged. Whenever I have to deal with local evidences of septic infection, I use an ointment essentially the same as this, and have learned to count on it with more reliance than anything that I have ever resorted to. This one better thing hinted at above is Credé's silver ointment, which is to be used as described. As the disease becomes mitigated, the ointment may, if desirable, be reduced with simple lard, and may be discontinued when local signs have disappeared. Absorption of any of these preparations may be hastened by a series of scratches over the affected area with the sharp point of a knife, not deep enough to draw blood, but deep enough to better expose the absorbent vessels of the skin."

The special applications of mercury to the treatment of syphilis are so important as to deserve more extended consideration than is given to other diseases, and will therefore be considered here at some length.

Inunction Method.—Mercury may be applied to the skin with a view to absorption, and for this purpose the ointment or the oleate may be used, a piece the size of a marble or larger being rubbed upon the inner side of the arms and thighs once or twice daily. The place of inunction must be changed, as the mercury causes some local irritation, and a crop of papules is likely to follow its repeated application to the same spot. A small piece of ointment may be rubbed upon the soles of the feet before putting on the stockings each morning, the friction in the act of walking being sufficient to cause absorption. In the case of infants suffering with congenital or acquired syphilis, the ointment may be rubbed upon the abdomen under the belly-band. This method is resorted to when it is desired to impress the system rapidly, as, for instance, in the treatment of the inflammatory manifestations of syphilis, especially in iritis. The constitutional effect can be most rapidly obtained in this way without disturbing the digestive organs.

Lerch[1] gives the following directions for tertiary syphilis: The mercury may be given by inunction in doses from 3 grams to 7.78 grams (45 to 120 grains) of blue ointment. This quantity should, in severe cases, be used each twenty-four hours.

The patient is directed to divide the amount into two equal parts, and use the one for each leg over the inside, with vigorous massage. It is necessary to continue the rubbing for fifteen minutes over each side to cause absorption, and it is best to control the time by the watch, as the process is tedious and too often the time of rubbing is shortened by the patient. The second day the process is repeated over the inside of the thighs in the same manner, the third day the inside of the arms, fourth day, chest and abdomen; the fifth day the back must be treated, and on the sixth day a full warm bath for cleansing purposes is administered. To prevent colds, especially during the winter, the patients are directed to use the inunction before retiring.

[1] *The Medical Standard*, December, 1905.

The patient may use the inunction himself during the first four days, after full instructions, or all may be given by a professional masseur. Thirty inunctions generally constitute a full treatment. In other words, the process has to be repeated six times.

The late M. Quinquaud, of Paris, claimed that the application of a mercurial plaster over the spleen is an efficient and convenient method of administering mercury in syphilis. The preparation of which he made use was composed of 60 parts of diachylon plaster, 20 parts of calomel, and 6 parts of castor-oil. If a second plaster was not used the metal continued present in the urine for a month or six weeks. By the alternate use and disuse of the plaster during periods of eight days ptyalism is said to have been entirely avoided. The plasters employed were four inches square.

In severe cases of constitutional syphilis, Dr. Dymnecki has found it of advantage to associate the internal administration of quinine with the inunction of mercury. The class of cases in which this combination proved valuable was marked by increased tissue-change. In syphilis, especially when the infiltration is marked upon the skin, the efficacy of one of the mercurial ointments may be increased by combining with some stimulating oil or green soap:—

℞ Ungt. hydrargyri nitratis,		
Sapo viridis	aa 46|5	Gm. or ʒiss.
Ol. eucalypti	2|	c.cm. or f3ss.—M.
℞ Ungt. hydrargyri ammoniat.	62|	Gm. or ʒij.
Olei anthemidis	2|	c.cm. or f3ss.—M.
℞ Ungt. hydrargyri oleatis (10 vel 20 per cent.)	62|	Gm. or ʒij.
Olei cadini	7|5	c.cm. or f3ij.—M.
℞ Ungt. hydrargyri oleatis (10 per cent.)	31|	Gm. or ʒj.
Olei caryophylli	1|2	c.cm. or *m*xx.—M.

On the basis of his clinical experience, Dr. Joseph Dymnecki also advocates a combination of sulphur-baths and mercurial inunction. He believes that the baths promote the action of the mercury, and finds that the chemical incompatibility detracts nothing from the therapeutical effects. Watraszewsky prefers the use of calomel soap to mercurial ointment in the treatment of syphilis. The soap is made by triturating pure olive-oil soap with calomel in the proportion of one to two or three. A piece of the soap equal to 2 Gm. (or gr. xxx) is rubbed into a selected part of the body until nothing remains but the foam. This is furthermore rubbed until it also disappears. The method is cleanly, does not irritate the skin, and requires but ten or fifteen minutes for its execution. Another method of keeping mercury in continued contact with the skin is that adopted by Peroni, who adds to the solution of gutta-percha a quarter of its weight of calomel. After the patient has bathed, his back is painted with the solution, and when the chloroform has evaporated a mercurial varnish remains closely adherent to the skin. This practice has been found of service when the internal use of mercury is badly borne and is suitable to children afflicted with hereditary syphilis or late cutaneous manifestations. Welander has convinced himself, by comparative experiments, that a greater quantity of mercury is absorbed by the simple application of blue ointment to the skin than when friction is employed. If rubbed upon the skin before the patient goes to bed the bodily

heat vaporizes the metal, which is absorbed by the skin and lungs. He advises, therefore, that an excess of the ointment should be used in order that absorption should be continuous. The therapeutic effect of mercurial inunctions and pillow-slip method of administering mercury, Kutner[1] believes to be largely, if not entirely, due to the inhalation of the mercurial fumes, and not the absorption or taking up of the drug by the skin. He rubs the mercury into an air-tight box from which the fumes are inhaled through a rubber tube and mask for half an hour a day. Mercury is found in the urine as in other methods of administration. No toxic effects have been observed in any of the many patients so treated, and in each case recovery resulted.

The advantages of the inhalation method are that the "inhalation dose" can be accurately determined and regulated, and the many annoyances attending the inunctions are done away with. Although stomatitis does not result, it is best to gargle with potassium-chlorate solution after each inhalation. The author evinces considerable enthusiasm over this method of administering mercury, and, judging from his results, his enthusiasm is justifiable.

Often the most rapid way to mercurialize a patient is by using the drug in the form of suppositories. Fumigation is also a method of introducing mercury into the blood by way of the skin. The usual method is to place the patient in a vapor-bath until he is perspiring freely, and then to expose the body to the fumes arising from 0.65 to 1.30 Gm. (or gr. x-xx) of calomel sublimated by the flame of an alcohol-lamp. The fumes should not be inhaled, and, therefore, the patient sitting on a chair has a blanket or his clothing fastened around his neck and extending down to the floor all around, making a canopy; under the chair is placed a small spirit-lamp, and over it, upon a sheet of tin, is placed the mercurial. The patient, after about fifteen minutes' exposure, is wrapped up in dry, warm blankets, and the skin allowed to dry spontaneously. If perspiration continue, it may require a small dose of atropine. In this way the mercury is deposited upon the skin, and is gradually absorbed, producing the greatest impression with the least disturbance. This method is especially valuable in controlling the skin disorders attending syphilis (syphilides), and in the treatment of other manifestations of the poison when mercury is not well borne by the bowels.

The hypodermic method of administering mercurials has been practiced both in France and in Germany, and, to a less extent, in this country. For this purpose solutions of corrosive chloride (hydrarg. chlor. corr., 0.065 Gm., or gr. j; aquæ destillatæ, 7.5 c.cm., or f℥ij. Sig.: 0.60 c.cm., or *m*x, a dose once a day) have been gradually increased, by drops, until 50 or more are administered, or until the physiological action of the mercury is apparent. This plan of treatment is as cleanly, quick in results, and more successful than any other in preventing relapses.

It may, however, cause irritation, and has, in some rare instances, when given improperly, led to abscess and sloughing. If the hypodermic needle be properly inserted, the instrument and needle aseptic, the author has never observed any case of abscess follow the hypodermic injection of the corrosive chloride of mercury. The moment the least mercurial impression is made by the subcutaneous injection, the dose should be reduced to the smallest amount. A few minims of the solution already named should be again in-

[1] *Berliner klinische Wochenschrift*: *Medical Standard*, March, 1900.

jected into the muscle or skin, and the system kept under the impression of the drug by injections every day or two, until all evidence of syphilis disappears. In place of using small doses of mercury every day hypodermically, the writer sometimes, especially in lean subjects, injects from 0.015 to 0.02 Gm. (or gr. $^1/_4$-$^1/_3$) of corrosive sublimate two or three times a week into the muscular tissue of the gluteal region or back. The hypodermic method thus administered is for old cases of syphilis, especially in broken-down individuals, and offers a most positive way of limiting or curing the disease.

The mercurial, when injected in these large doses, is, as the rule, slowly absorbed and exerts only a therapeutic, and not a toxic, action.

The albuminate and peptonate of mercury have been proposed with a view to obviate any accidents, but constitute little, if any, improvement.

The glutin-peptone sublimate, another compound used in the same manner and for the same purpose, is obtained by the action of hydrochloric acid on gelatin. It contains 25 per cent. of corrosive sublimate, and is a white, hygroscopical powder, which readily assumes the form of a colorless, non-corrosive fluid. This preparation is used in doses of 1 Gm. (or gr. xv), and is said not to occasion much pain nor give rise to abscesses.

In the clinic of the late Professor Auspitz the following solution was employed:—

℞ Hydrarg. chlor. corrosivi	1	Gm. or gr. xv.
Sodii chloridi	2	Gm. or gr. xxx.
Aquæ destillatæ	90	c.cm. or f℥iij.

M. Dose: 0.60 to 2 c.cm. (or *m*x-xxx) every second day hypodermically.

Mathes states that no irritation results beyond a little tumefaction. About twenty or thirty injections constituted the course of treatment, which resulted in a cure. Liebreich recommends the formamidate of mercury, which does not coagulate albumin, is neutral in reaction, readily combines with water, and is not precipitated by alkalies.

Formamidate of Mercury[1] is prepared as follows: 10 to 13 Gm. (or ʒiiss-iii $^1/_4$ of freshly-precipitated, completely-washed, and still moist mercuric oxide are gently warmed with a little water in a porcelain capsule, with a gradual addition of 9.25 c.cm. (or fʒiiss) of formamide (resulting from the reaction of ammonia upon ethyl-formate). As soon as solution has taken place the resulting colorless liquid is filtered into a litre flask, and the latter filled to the litre-mark with distilled water. Each cubic centimetre (or *m*xv) contains 0.01 Gm. (or gr. $^1/_6$) of mercury, which is one hypodermic dose. It should be dispensed in brown-colored bottles. Zeissel, of Vienna, after trial of this agent, was well satisfied with it, and found twenty injections the maximum number required to disperse the syphilitic manifestations, even in severe cases. Kopp's[2] conclusions from over three thousand injections were less favorable; he says that "Liebreich's preparation is decidedly useful in certain of the milder forms of primary syphilis, as also for slight secondaries. The formamide should not be employed in severe cases where there are large papules or thick infiltrations; inunction is still the best method of treating these cases. The tertiary forms are likewise not to be treated by the formamide. Relapses are by no means prevented by Liebreich's method; on

[1] "Notes on Hydrargyrum Formamidatum," by J. C. Wilson, M.D., *Philadelphia Medical Times*, vol. xiv, p. 149.

[2] *Vierteljahrschrift für Dermatologie und Syphilis*, 1885.

the contrary, they appear to be extraordinarily common after this treatment." In order to obtain more permanent effects than are possible by the use of the soluble preparations, it has been thought that by depositing the more stable compounds under the skin a more lasting effect can be obtained, and calomel is now used in this manner. The calomel may be suspended in liquid vaselin or olive-oil (1 in 10). There should be at least a week's interval between the injections, which are usually thrown deeply into the tissues of the buttocks or retrotrochanteric space (Besnier). The part should be washed with antiseptic solution, and the needle sterilized before each operation; the puncture should be immediately covered with emplastrum de Vigo or by a drop of collodion.[1] It should be pointed out that the subcutaneous injection of calomel, gray oil, or other insoluble preparation of mercury, is not without danger. There is a local deposit of the mineral at the point of injection, with continuous slow absorption. Embolic pulmonary infarction has occurred in direct consequence of the procedure, while in other cases a dysenteric condition was established.

Mercury benzoate and other mercurial preparations have been used in the same manner for the same purpose. Gray oil is much in vogue in Vienna, while the salicylate, yellow iodide, and cyanide have been experimentally employed by Roussel and Chernoguboff. Gray oil consists of mercury, lanolin, and olive-oil. A case has lately been reported in which a 30-per-cent. solution (hydrarg., lanolin, aa 3 parts; olei olivæ, 4 parts) had been used during seven weeks as a subcutaneous injection. At the date of the last injection no sign of mercurialism was present, but a week later the gums became tender, ptyalism and violent gastro-enteritis soon ensued, and in a month the patient died. The formula for administering the salicylate of mercury, employed by Keyes and Chetwood in 1894, was liquid petrolatum (1.8 c.cm., or *m*xxx, holding in suspension 0.11 Gm., or gr. iss, of the salicylate). D. A. Sinclair, of New York, reports[2] satisfactory results from weekly injections of the above into the muscular tissues, generally in the gluteal region. In severe cases, he injected 0.4 Gm. (or gr. vj) at once without any but the most gratifying results. The ordinary dose, however, is 0.1 Gm. (or gr. iss), suspended in oil (allowing 0.016 Gm., or gr. $^1/_4$, for loss). Due care must be exercised to keep the mouth in good condition. The treatment is kept up for three years.

Neumann has, in a number of cases, employed asparagin hydrargyrate prepared by dissolving 10 Gm. (or 3iiss) of asparagin in warm water and adding mercuric oxide until no more dissolves. The solution, when cold, is filtered and the amount of mercury calculated. It is then diluted to the strength of $^1/_2$, 1, or 2 per cent. This solution is a limpid, colorless fluid, devoid of odor, but possessing a sharp, acrid, and metallic taste. It contains no excess of asparagin. A daily injection, generally in the interscapular region, was made of 1 c.cm. (or *m*xv) of the 1-per-cent. solution, being equal to 0.01 Gm. (or gr. $^1/_6$). Asparagin hydrargyrate is distinguished by the rapidity with which it is absorbed and eliminated. The injections are well borne and accidents are rare.

The succinimide of mercury is a compound concerning which a report

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[1] *Revue Générale de Clinique et de Thérapeutique*, Sept. 12, 1889.
[2] *New York Medical Journal*, October 22, 1904.

has been favorably made by Julien. The salt occurs in the form of long needles, and is very soluble in water and alcohol. He made use of a solution in distilled water, each cubic centimetre (or *m*xv) of the fluid containing 0.0027 Gm. (or gr. $^1/_{24}$) of succinimide of mercury. From $^1/_2$ to 1 c.cm. (or *m*viiss-xv) of the solution was injected every day and gave rise neither to pain nor irritation. The treatment was found efficient, most of the cases being in the secondary stage. An average of twenty-two injections was made in each case. No salivation was produced. The drug was, in other cases, administered by the mouth in doses of 0.02 to 0.03 Gm. (or gr. $^1/_3$-$^1/_2$) with advantage, though the treatment was more prolonged.

The double hyposulphite of mercury and potassium occurs as colorless crystals, easily soluble in water, and contains 31.4 per cent. of mercury. For hypodermic injection 0.25 Gm. (or gr. iv) is dissolved in 9.25 c.cm. (or f℥iiss) of distilled water and from 0.50 to 1 c.cm. (or *m*vii-xv) is employed, equal nearly to 0.005 to 0.01 Gm. (or gr. $^1/_{12}$-$^1/_6$) of the corrosive sublimate.

The salicylate of mercury may be readily prepared, according to the following formula of Vacher:—

℞ Hydrarg. chlor. corrosivi	1	Gm. or gr. xv.
Sodii salicylat.	2	Gm. or gr. xxx.
Aq. destillat.	90	c.cm. or f℥iij.

M. Each cubic centimetre (*m*xv) contains 0.01 Gm. (or gr. $^1/_6$) of salicylate of mercury.

Another mercurial salt which has been employed for hypodermic use in syphilis is the thymolacetate. The injection is said to cause but little pain, and is made every eight or ten days. Dr. Tranjen makes use of the same preparation in tuberculosis. Dose, 0.10 Gm. (or gr. iss) in albolene or glycerin.

Moncorvo and Ferreira have extended the use of hypodermic injections to infantile syphilis, using by preference the corrosive sublimate and gray oil. The former was given in doses of 0.0006 to 0.002 Gm. (or gr. $^1/_{100}$-$^1/_{33}$) to children varying from three months to fourteen years of age. The amount of gray oil injected is said to have been "from two-fifths to the whole of a Pravaz syringe," the ages of the patients ranging from thirty-eight days to twelve years. The result is stated to have been rapid improvement as regards the cutaneous lesions and decided gain in weight and general condition.

It is claimed that if pure guaiacol be incorporated with the oil used as a medium for intramuscular injections of mercurials, the process is rendered practically painless. The following formula is the one recommended, the guaiacol being employed in the proportion of 3 per cent.:—

℞ Hydrarg. iod. rubr.	5	Gm. or gr. viij.
Guaiacol. pur.	3	c.cm. or *m*xlv.
Ol. olivæ ster.	90	c.cm. or f℥iij.

M. Sig.: For hypodermic use.

The injections are practiced daily or every other day, 2 c.cm. (or *m*xxx) representing approximately 0.01 Gm. (or gr. $^1/_6$) of the biniodide. The needle should be inserted perpendicularly to the skin, pushed in its full length, and the liquid injected very slowly, the buttocks being chosen as the best location for the operation.

The Intravenous Injection of Mercury.—Dr. Walter L. Pyle,[1] in a recent article, says that the advantages of this method are: 1. There is absolute certainty of absorption. 2. There is no pain to speak of. 3. There is no disturbance of the digestive tract during treatment. Slight salivation and diarrhœa, temporary only, are the only local disturbances reported. 4. There is more rapid absorption and therapeutic effect than by any other method. 5. Less of the mercurial salt is required. 6. Absolute exactitude of dosage can be obtained. 7. Not a single accident has been recorded. 8. The method is perfectly reliable. All cases reported have shown some improvement, and never any retrogression. 9. Abscesses do not form. 10. There are no cutaneous irritations or eruptions, such as follow friction or inunctions. 11. The nervous symptoms sometimes associated with the hypodermic method are never observed with the intravenous injections. 12. It is successful often when all other methods fail. 13. There is no history of recurrence after a cure. 14. Mercuric chloride has a preservative action on the red blood-corpuscles, and hence must be valuable intravenously in such a disease as syphilis, in which there is a strong tendency toward destruction of the red blood-corpuscles and subsequent anæmia. The disadvantages are: 1. The needle may not reach the vein; but this can be remedied by applying the needle first and awaiting the appearance of a few drops of blood. 2. Some of the blood may extravasate into the subcutaneous tissue, adjacent to the point of injection; but this has rarely occurred, and the blood is soon absorbed. 3. There is likely to be a slight stomatitis at first. 4. There is the appearance of albumin in the urine after the injections, which, however, often follows hypodermic administration. 5. There is, as in all intravenous injections, a subsequent polyuria and increase of urea, but neither has any special disadvantage. 6. During the injection, through a reflex action on the circulatory centre, fainting may supervene, but is of no vital import. 7. Jemma has seen slight salivation immediately after the injection of small doses. This is liable to happen in any administration of mercury. In the opinion of the author the advantages so far overbalance the objections that, viewing the present *status* of treatment, we can but accept this as the most successful. He would not, however, advocate it in cases easily amenable to ordinary treatment or in the early stages of syphilis, but considers it of especial value in obstinate cases, resisting other treatment, or in advanced cases of organic syphilis, or when immediate relief is urgently called for by reason of pain, encroachment on a vital part, or rapid destruction of tissue. Investigation may prove it to be most valuable immediately after the diagnosis is made, eliminating or destroying the syphilitic virus before it has produced any decided effect on the general system. At present there is no evidence to warrant this statement; but, as the method is virtually devoid of dangerous or untoward results, it should be given some trial in the beginning of the disease.

In two cases of cerebral syphilis which had proved unamenable to treatment, Baccelli resorted to the intravenous injection, usually into the superficial veins in front of the elbow, of corrosive sublimate with excellent results. The solution was of such strength that 1 c.cm. (or *m*xv) corresponded (about) to 0.0004 Gm. (or gr. $^1/_{172}$), and this was the amount injected to begin with, the operation being practiced every day and the dose being increased to 0.0027 Gm. (or gr. $^1/_{24}$):—

[1] *Medical News.*

℞ Hydrarg. chloridi corrosivi	1	Gm. or gr. xv.
Sodii chloridi	3	Gm. or gr. xlv.
Aquæ	1000	c.cm. or Oiif3xiv.—M.

In syphilis, the rôle of mercury has been considerably abbreviated in recent years. There is no denying that it does rapidly control the early manifestations of syphilis and also those of congenital syphilis, so that it may be considered, within limits, as antagonistic to the syphilitic poison. The investigations of Leon Levi show that, in syphilitic subjects, the salts of mercury favor metabolism, improve nutrition, increase the corpuscles and hæmoglobin of the blood, and augment the weight and the muscular strength.

From a study of ninety-seven cases, Weilander states that, during the administration of mercury in syphilis, the urine contained casts, the number of which increased with the length of the treatment. After discontinuance of the remedy the casts disappeared, as a rule, within a month or six weeks, without causing temporary or permanent injury to the kidneys.

As mercury is most efficient when it encounters the poison in the blood, it should be given as soon as induration is observed around the primary sore, and the treatment by small doses, avoiding ptyalism, maintained for several months. In some cases there will be no further symptoms; in others, secondaries will appear, but will be much modified. In the secondary stage the mercurial may be combined with iodides, and the tertiary manifestations are generally best treated by iodine without mercury. The mercury with chalk is preferred by Mr. Hutchinson, of London (0.065 Gm., or gr. j, four times daily); Ricord prefers the yellow iodide (0.02 Gm., or gr. $^1/_3$, three times daily). Calomel is used by some, corrosive chloride by others. The elder Gross was fond of a biniodide made extemporaneously, as follows:—

℞ Hydrarg. chlor. corrosivi		065 Gm. or gr. j.
Potass. iodidi	4	Gm. or 3j.
Aquæ destillatæ	180	c.cm. or f3vj.

M. Sig.: A tablespoonful three times a day.

It may be given directly, as in the "Syrup Gibert":—

℞ Hydrarg. iodidi rubr.		20 Gm. or gr. iij.
Potassii iodidi	6	60 Gm. or gr. cij.
Aquæ destillatæ	11	c.cm. or f3iij.
Cola et adde		
Syrupi	q. s. ad 300	c.cm. or f3x.

M. Sig.: A half to a tablespoonful three times a day.

Hurd[1] writes that the country physicians, as a rule, prefer the "mixed treatment," believing that the combination of mercury with potassium iodide is admirably adapted to secondary syphilis, and that much less mercury is needed when the mercurial is given along with the iodide.

The carbolate of mercury is highly esteemed by some writers, as being rapidly absorbed and capable of being given for a long time without causing salivation.

In administering mercury for the treatment of syphilis, the author recommends the preparation or the combination with it which he deems best for each case, depending in all instances upon the patient's system.

[1] "The Place of Mercury in Therapeutics," by E. P. Hurd, M.D., *Therapeutic Gazette*, Jan. 15, 1891.

Some do best upon calomel, others upon gray powder or the corrosive chloride, while in very many instances the biniodide or blue pill acts more decidedly. One after the other of the various mercurials first named has often to be tested, or combinations containing them made, before the form of the drug suitable to the case under consideration can be selected and its use continued for a proper time.

In the treatment of secondary and tertiary syphilis by mercury the author suggests the following formulæ:—

℞ Hydrargyri chloridi corrosivi ..... | 065 Gm. or gr. j.
Fluidextracti xanthoxyli..... 150 | c.cm. or f℥v.

M. Sig.: Two teaspoonfuls in water three or four times a day.

℞ Hydrargyri chloridi mitis ..... | 32 Gm. or gr. v.
Sacchari albi ..... 2 | Gm. or ℥ss.

M. et ft. in chartulæ no. x.
Sig.: A powder three or four times a day.

℞ Hydrargyri iodidi flavi ..... | 32 Gm. or gr. v.
Quininæ sulphatis ..... 2 | 60 Gm. or gr. xl.

M. et ft. pil. no. xx.
Sig.: A pill three or four times a day.

℞ Massæ hydrargyri,
Pulveris zingiberis,
Pulveris capsici .....aa | 65 or 1 | 30 Gm. or gr. x vel xx.

M. et ft. pil. no. x.
Sig.: A pill three or four times a day.

℞ Hydrargyri cum cretâ,
Pulveris glycyrrhizæ ..... aa | 65 Gm. or gr. x.
Creosoti ..... | 06 c.cm. or *m*j.

M. et ft. chartulæ no. xx.
Sig.: From four to six powders a day.

℞ Hydrargyri chloridi corrosivi ..... | 065 Gm. or gr. j.
Fluidextracti stillingiæ..... 60 | c.cm. or f℥ij.
Tinct. gent. comp. ..... 90 | c.cm. or f℥iij.

M. Sig.: Two teaspoonfuls in water three times a day.

Mention has already been made of various methods of treating syphilis, and it is only needed to add that 4 or 8 Gm. (or ℥i-ij) of corrosive mercuric chloride with twice as much common salt can be added to a bath for syphilitic subjects with skin-lesions. When the patient is much broken down, cachectic, and anæmic, mercury should only be given in the tonic doses already mentioned; but, as a rule, it is better that the general health should be built up before putting the patient on a mercurial course.

A novel treatment of acute articular rheumatism is advocated by Singer.[1] He recommends a solution

℞ Hydrarg. chlor. corrosivi,
Sodii chloridi ..... aa | 13 Gm. or gr. ij.
Aquæ destillatæ ..... 10 | c.cm. or *m*clx.—M.

of which one-eighth is to be injected into the vein at the bend of the elbow, first thoroughly sterilizing the surface and applying a bandage around the

[1] *Centralblatt für die Gesammte Therapie*, June, 1898.

arm to make the veins prominent; the bandage is removed after the needle is introduced into the vein. He practiced this upon the two arms alternately. He observed diminution of fever and of articular pains. Contra-indications are general debility, renal disease, and idiosyncrasy.

As a rule, the mercurial preparations should, as much as possible, be given alone, avoiding combinations that either lessen their efficiency or possibly make them more active than is desirable.

Hydrargyrum pyroborate is a new salt which has been used to fulfill the indications of mercury. The pyroborate is a brown, amorphous powder, insoluble in water, ether, or alcohol. It has been made into an ointment (1 to 50) with vaselin, or, when designed for absorption, with lanolin.

Mercurous tannate, an odorless and tasteless salt, insoluble in the ordinary menstrua, contains about 50 per cent. of metallic mercury and is used by Lustgarten in doses of 0.20 to 0.32 Gm. (or gr. iii-v). It is said that this combination does not salivate or disturb the digestive functions. **Mercuric gallate,** which contains about 37 per cent. of mercury, is said to be more stable than the tannate and to cause no mercurial intoxication.

Hydrargyrol, Mercury Paraphenylthionate, is a compound of the formula $C_6H_4.OH.SO_3Hg$. It was introduced by Gautrellet as a *succedaneum* for corrosive sublimate, over which it is said to have the advantage of not precipitating the albumin of the tissues and of being seventy-five times less toxic. It occurs in the form of brownish-red scales, having an odor resembling that of ginger-bread. Its specific gravity is 1.85, and in reaction it is neutral. It is insoluble in absolute alcohol, but quite freely soluble in water and glycerin, yielding beautiful ruby-red solutions.

According to Gautrellet, hydrargyrol in 1 to 250 solution completely sterilizes bouillons; and introduced into a growing culture it precipitates the alkali toxins. Its solutions are stated to be neither caustic nor even irritant.

Hyrgolum is metallic quicksilver in allotropic form, Hydrargyrum colloidale (von Leyden). It is soluble in water, and is used in 10-per-cent. ointment for inunction in syphilis, causing less irritation than blue ointment. It may also be given in pill form, 0.03 Gm. (or gr. ss) thrice daily. Dr. Gottheil, of New York, uses a 1-per-cent. solution, in water, in the treatment of infantile syphilis, giving 0.18 to 1.20 c.cm. (or *m*iii-xx) thrice daily.

Mercurol is a compound with nuclein in powder form, containing 10 per cent. of mercury. It is bactericidal, but is neither caustic, nor irritating. In gonorrhœa and cystitis, solutions of $^1/_2$ to 3 per cent. are employed for irrigation, with much success. For treatment of conjunctival affections, especially of infectious character, 3- to 5-per-cent. solutions are employed. An ointment may also be used (5 per cent.), which is applied to ulcers and burns, and as an antiseptic dressing for abscesses. It may be used as a dusting powder in full strength for indolent ulcers; or in 2-per-cent. solution, as a wet dressing. The latter is also used as an injection in gonorrhœa. It is used internally in syphilis in doses of 0.045 Gm. (or gr. $^3/_4$), twice daily, which may be increased. This is to be distinguished from **Mercuriol,** which, according to Dr. Lengefeld, consists of an amalgam of mercury with slight amounts of magnesium, aluminum, anhydrous lanolin, and almond-oil. It is prepared for use by hypodermic injection by adding an equal quantity of sweet almond-oil. The dose recommended is 0.05 to 0.2 c.cm. ($m^3/_4$ to iij),

every fifth day. The injection should be made deeply into the muscle. The amalgam is decomposed by water. The remedy acts like hydragyrum salicylate.

HYDRASTIS (U. S. P.), HYDRASTIS RHIZOMA (B. P.).—Hydrastis.

Preparations.

Fluidextractum Hydrastis (U. S. P.).—Fluid Extract of Hydrastis (contains 2 per cent of hydrastine). Dose, 0.30 to 2 c.cm. (or *m*v-xxx).

Hydrastina.—Hydrastine. Dose, 0.015 to 0.03 Gm. (or gr. ¼ to ½).

Hydrastininæ Hydrochloridum (U. S. P.).—Hydrastinine Hydrochloride. Dose, 0.03 to 0.13 Gm. (or gr. ss-ij).

Glyceritum Hydrastis (U. S. P.).—Glycerite of Hydrastis (1 Gm. to 1 c.cm.). Dose, 2 to 4 c.cm. (or f3ss-j).

Tinctura Hydrastis (U. S. P., B. P.).—Tincture of Hydrastis (20 per cent.; B. P., 10 per cent.). Dose, 2 to 4 c.cm. (or f3ss-j).

Extractum Hydrastis Liquidum (B. P.).—Liquid Extract of Hydrastis. Dose, 0.30 to 2 c.cm. (or *m*v-xxx).

Pharmacology. — The official portions of golden seal, Hydrastis canadensis, are the rhizome and roots. It is a small plant belonging to the Ranunculaceæ, and grows in rich, moist woods, from Canada to Carolina, in the Alleghenies and westward. Its most important constituents are **Hydrastine,** a white crystalline alkaloid, not bitter, although leaving an acrid sensation in the mouth and throat, **Berberine,** a yellow and intensely bitter, crystalline alkaloid, and **Canadine.**

Hydrastis also contains a resin, starch, sugar, and a volatile principle. The substance commercially known under the name of hydrastin is an impure muriate or hydrochloride of berberine. By decomposing hydrastine with the aid of gentle heat and diluted nitric acid, a new alkaloid, **Hydrastinine,** is formed, together with opianic acid. The hydrochloride of hydrastinine, now official, is "the hydrochloride of an artificial alkaloid derived from hydrastine." It is soluble in water and alcohol, but dissolves sparingly in ether and chloroform. The official glycerite of hydrastis is an efficient and elegant preparation, of the strength of a fluid extract (1 Gm. to 1 c.cm.).

Physiological Action.—Hydrastis owes its activity to the hydrastine which it contains, which has oxytocic properties, and is abortifacient. It has also some antiperiodic qualities, though ranking much below cinchona. In small amounts, it promotes appetite, increases the gastric secretions, acts as a cholagogue, and stimulates peristalsis; in larger doses it deranges digestion and causes constipation. In poisonous doses, death may be caused by its action upon the nervous system, from convulsions or paralysis, and from failure of respiration. Introduced into the circulation, it causes rise in pressure after a preliminary fall; if in large dose, the pressure falls, the irritability of the vagus is destroyed, and the heart's action is arrested in diastole. F. Miodowski reports a case of a man, 69 years of age, suffering with bronchitis and excessive expectoration, with weak heart, in which two doses of 1.20 c.cm. (or *m*xx) of the fluid extract of hydrastis brought on dyspnœa, with lividity of the face, and slow, easily-compressible pulse. The lungs were congested and œdematous, the heart apex-beat could not be felt. The prompt use of stimulants and counter-irritants caused the attack to pass off. It was thought that the drug had induced the attack by increasing the cardiac weakness.

The physiological action of hydrastinine has been studied by Serdtseff in many experiments upon cold- and warm- blooded animals. Small doses retard the heart's movements by stimulating the inhibitory apparatus, both peripheral and central. It increases and strengthens uterine action by an influence derived from the cerebral nervous system, probably by way of the vasomotor nerves. Dr. David Cerna has determined that hydrastinine destroys the irritability of muscular tissue and the excitability of motor nerves. Very large amounts produce loss of functional activity of the sensory nerve-fibres and also cause anæsthesia when locally applied. Small quantities increase reflex activity by stimulating the spinal cord.

As hydrastine is eliminated chiefly by the kidneys, it exerts some diuretic action. Rutherford found that it also has a decided action on the liver. The derived alkaloid, hydrastinine, being sparingly soluble in water, the hydrochloride of hydrastinine has been employed, and the result of the investigation shows it to possess powers like ergot. It is used in 5- to 10-per-cent. solution, hypodermically. The injections do not cause pain and do not discolor the tissues, but they so readily control hæmorrhage, and especially uterine hæmorrhage, as to constitute this agent a rival of the preparations of ergot. Wild reports several cases in which the hypodermic use of hydrastinine gave rise to painful inflammatory patches in the throat.

Bordet asserts, as the result of his experience, that hydrastinine hydrochloride has no influence in arresting hæmorrhage from the womb during labor or the puerperal period. The progress of involution is also unaffected by the salt.

Therapy.—Hydrastinine hydrochloride, 0.20 Gm. to 30 c.cm. (or gr. iii to f℥j) of glycerin, the late Dr. Keyser reported as excellent in some cases of conjunctivitis granulosa. It is also used in nasal catarrh, and in uterine catarrh, or leucorrhœa, both internally and locally. In gonorrhœa, after the acute stage is passed, we may use hydrastine (commercial) in water (1 per cent.) twice daily, or 2 c.cm. (or f℥ss) of fluid extract may be added to 240 c.cm. (or Oss) of water, and used as an injection in subacute gonorrhœa, vaginitis, and leucorrhœa. As a mouth-wash, in syphilitic affections, the tincture may be added to water and freely used. The fluid extract, either in full strength or diluted with water, is likewise a beneficial local remedy in mercurial or aphthous stomatitis and follicular pharyngitis. The same application may be made with advantage in fissured nipples and otorrhœa. Hydrastis and hydrastinine hydrochloride possess a sphere of usefulness in dermatology.[1] From 0.13 to 0.38 Gm. to 30 c.cm. (or gr. ii-vi to f℥j) of water, or distilled witch-hazel, makes an excellent lotion in hyperidrosis. Its stimulant effect upon the sebaceous glandular system renders it also of avail in acne and dry seborrhœa. A useful ointment may be prepared by incorporating 0.32 to 2 Gm. (or gr. v-xxx) of hydrastinine hydrochloride in 31 Gm. (or ℥j) of ointment basis. Hydrastine ointment stimulates ulcers to repair and at the same time destroys the fœtor of unhealthy discharges. For this reason it may be appropriately used as a dressing upon ulcerated carcinoma and in bromidrosis. This ointment is an excellent application to chancroids and chronic eczema:—

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[1] See paper by the author, on "Hydrastis and Hydrastinine Hydrochlorate in Diseases of the Skin," in the *Medical Bulletin* for May, 1885.

℞ Extracti ergotæ,
Betanaphthol..... aa 2| Gm. or 3ss.
Hydrastininæ hydrochloridi..... |32 or 1|30 Gm. or gr. v vel xx.
Bismuthi subnitratis ..... 4| Gm. or 3j.
Unguenti simplicis ..... q. s. ad 31| Gm. or 3j.

M. Sig.: Useful in hyperidrosis, bromidrosis, acne, and seborrhœa.

℞ Hydrastininæ hydrochloridi..... |32 or 1|30 Gm. or gr. v vel xx.
Betanaphthol..... 2| Gm. or 3ss.
Tinct. quillajæ ..... 15| c.cm. or f3ss.
Tinct. hamamelidis (B. P.)..... q. s. ad 120| c.cm. or f3iv.

M. et ft. sol.
A lotion for hyperidrosis, acne, and seborrhœa.

℞ Fluidext. hydrastis,
Fluidext. ergotæ..... aa 30| c.cm. or f3j.

M. Sig.: Use as a local application. In fissure or prolapse of the anus, ulcerations of the rectum, hæmorrhoids, and ulcerations or erosions of the os uteri.

Unhealthy ulcers, sloughing sores, and chancroids are benefited by the local application of the fluid extract. In affections of mucous membranes, especially of catarrhal character, hydrastis and its preparations are most efficient. In the chronic gastric catarrh of drunkards, in duodenal catarrh with or without jaundice, or chronic catarrh of the intestine with ulceration, it is an excellent remedy. As a vegetable, bitter tonic, it is employed in anorexia and convalescence from fevers.

According to Fedorow, the fluid extract of hydrastis, in doses of 1.20 c.cm. (or *m*xx) four times daily, is an excellent remedy in the treatment of obstinate vomiting of pregnancy. Jordan[1] reports that in an obstinate case of membranous dysmenorrhœa 1.54 c.cm. (or *m*xxv) of the fluid extract of hydrastis twice daily, beginning eight days before each menstruation, was followed by a cure. In malarial attacks, it is less efficient than quinine in checking the paroxysms, but is useful as a stomachic and general tonic. Hydrastis lessens the discharge of albumin in chronic Bright's disease, and of mucus in catarrh of the bladder. Schatz pronounces it a useful agent in controlling hæmorrhages from the uterus. The effects of hydrastis in cancer are very probably limited to its action as a motor nerve-tonic and its stimulating effect upon the digestive organs. The reports as to the favorable action of hydrastinine in uterine hæmorrhage have been confirmed by Gottschalk, Czempin, Kallmorgen, and other observers. An analysis of sixty-four obstetric cases has been published by Bossi in which he made use of hydrastis. He administered it with success in puerperal hæmorrhage, in placenta prævia during dilatation of the os uteri, and as a prophylactic against post-partum hæmorrhage from any cause. He employed the fluid extract in large doses (6.20 to 12.40 c.cm., or *m*c-cc, daily) for several days at any period during pregnancy without ill effect upon either mother or child.

Bleeding hæmorrhoids are successfully treated by Marini[2] with fluid extract of hydrastis, in sweetened water, 0.18 c.cm. (or *m*iij) being taken every hour during the day. In an obstinate case that had suffered with hæmorrhages for fifteen years, and in which hypodermic injections of ergotin

[1] *Centralblatt für Gynäk.*, No. 2, 1890.
[2] *Independence Médicale*, April 17, 1898.

had failed, this treatment caused cessation of flow in a few hours after its administration began. It was continued for ten consecutive days and there was no return of hæmorrhage. The same author pronounces hydrastis the best pulmonary hæmostatic. M. Marini maintains that it is the preferable remedy in the hæmorrhages of fibromyomas, and that it is the best means of combating the hæmorrhages of pregnancy at any stage, provided it is taken at sufficiently prolonged intervals—that is, 1.20 c.cm. (or *m*xx) every three hours or four times a day.

In conclusion, M. Marini lays down the following principal indications of the drug: 1. Hydrastis Canadensis administered at any stage during pregnancy, in amounts of from 6.20 to 12.40 c.cm. (or *m*c-cc) a day for several consecutive days, has no dangerous action on the mother or on the fœtus; it is the same when it is given during labor. 2. Administered either during pregnancy or during labor and delivery, as well as afterward, it exercises an invariable hæmostatic, curative, and prophylactic action on the uterus, without exercising any ecbolic action on the uterine muscle or moderating the contractions. 3. It is a much safer remedy in the hands of midwives than ergot.

M. Marini, as an oxytocic, found that it was not so rapid in its action as quinine, but he always used it without the least danger in the following formula:—

℞ Fluidextracti hydrastis	4	c.cm. or *m*lx.
Sodii salicylatis	2 30	Gm. or gr. xxxviij.
Sodii boratis	3	Gm. or gr. xlv.
Aquæ menthæ piperitæ	105	c.cm. or fʒiiiss.
Sacchari	q. s.	—M.

A dessertspoonful of this mixture is to be taken every half-hour until labor occurs. At the same time, two of the following capsules are to be taken every fifteen minutes:—

℞ Quininæ sulphatis	1	Gm. or gr. xv.
Caffeinæ	75	Gm. or gr. xij.

M. To make six capsules.

With the employment of these prescriptions, labor is hastened, postpartum hæmorrhage becomes less abundant, and there is less danger of vascular trouble.

According to Rousse,[1] hydrastinine hydrochloride, in pill form, is very effective in uterine hæmorrhages, phthisical night-sweats, hæmoptysis, epilepsy, and nephritis. Its hæmostatic action is particularly shown in all cases of congestive metrorrhagia, in menorrhagia, in hæmorrhage after parturition and abortion, in hæmorrhage consequent upon displacements of the uterus or diseases of the adnexa, and in hæmorrhage during pregnancy and labor. In myoma and carcinoma it is of no use. It has no unpleasant effects; it does not upset the stomach even when given in large doses. Hydrastinine is particularly distinguished from cotarnine by its greater rapidity of action, so that it may be recommended as a stimulant, in place of ether and camphor, in severe acute anæma. Cotarnine hydrochloride slows the action of the heart and gives tone to it, so that it is of great value after losses of blood.

[1] *Archives Internationales de Pharmacodynamie*, iv, 3, 4, and v, 1, 2; *Centralblatt für Gynäkologie*, Jan. 21, 1899.

On the other hand, it has no vasomotor action, although it strengthens and accelerates the contractions of the gravid uterus. Cotarnine acts more slowly, but more permanently, and is preferable in chronic uterine affections, especially venous stases. Both drugs increase the pains of labor, and probably may awaken them. Hydrastinine contracts the uterine and intestinal blood-vessels; cotarnine dilates them. The author thinks, therefore, that both remedies are useful in hæmorrhage due to uterine atony, but hydrastinine is to be preferred. Hydrastinine possesses unquestioned hæmostatic virtues, and Dr. Paul Strassmann, from an experience of twenty-seven cases, considers it efficacious in menorrhagia and metrorrhagia. He gave it in pill form in the dose of 0.03 Gm. (or gr. ss) and hypodermically as high as 0.065 to 0.13 Gm. (or gr. i-ij). In some cases, however, this dose proves insufficient and, in order to produce the same effect, must be repeated twice or thrice during the day. Such large doses, however, are unsafe; as the rule, the hypodermic dose should begin with not more than 0.01 or 0.015 Gm. (or gr. $^1/_6$-$^1/_4$).

Hydrastis is useful both in the hæmoptysis and night-sweats of phthisis and is strongly recommended by Kruse. He administered 2 c.cm. (or f℥ss) of the fluid extract in the evening, and the result was maintained for three weeks after a short course of this treatment had been discontinued. The ability of hydrastis to control profuse perspiration, not only in tuberculosis, but also in other diseases, is confirmed by Olszewski and other writers. According to the investigations of Porak, hydrastinine is of special utility in the hæmorrhages of puberty and the menopause and in those due to lesions of the appendages.

Hydrastinine has been proposed as a remedy in epilepsy, and in several cases its experimental use has been followed by a diminution in the frequency and severity of convulsions.

HYDROCOTYLE. — Water-pennywort, Indian Pennywort. Hydrocotyle Asiatica (Umbelliferæ, Orthospermæ), a perennial creeper indigenous to subtropical Asia, Africa, and America, contains a peculiar oleaginous substance termed **Vellarin,** which has a bitter taste and a strong odor. In small doses hydrocotyle is a strong stimulant to the skin. Large doses cause headache, stupor, and vertigo. This remedy has been employed in various chronic skin diseases attended by scaling and itching, in syphilitic and scrofulous lesions, lupus, psoriasis, eczema, and lepra.

Thirty-one Gm. (or ℥j) of the dried leaves, made into an infusion (with water, Oj), may be taken throughout the day. Hydrocotyle appears to exert a stimulating influence upon the genito-urinary apparatus.

HYDROGENII DIOXIDUM (see **Aqua Hydrogenii Dioxidi,** U. S. P., and **Liquor Hydrogenii Peroxidi,** B. P., under **Barium Dioxide**).

HYOSCYAMUS (U. S. P.).—**Hyoscyamus (Henbane).**

HYOSCYAMI FOLIA (B. P.).—**Hyoscyamus-leaves.**

Dose, 0.32 to 0.65 Gm. (or gr. v-x).

Preparations.

Extractum Hyoscyami (U. S. P.).—Extract of Hyoscyamus. Dose, 0.01 to 0.065 Gm. (or gr. $^1/_6$-j).

Fluidextractum Hyoscyami (U. S. P.).—Fluid Extract of Hyoscyamus. Dose, 0.06 to 0.30 c.cm. (or *m*i-v).

Hyoscyaminæ Hydrobromidum (U. S. P.).—Hyoscyamine Hydrobromide. Dose, 0.0003 to 0.0006 Gm. (or gr. $^1/_{200}$-$^1/_{100}$).

Hyoscinæ Hydrobromidum (U. S. P., B. P.).—Hyoscine Hydrobromide. Dose, the same, hypodermically.

Tinctura Hyoscyami (U. S. P., B. P.).—Tincture of Hyoscyamus (10 per cent., assayed; B. P., 10 per cent.). Dose, 1.20 to 4 c.cm. (or *m*xx-f3j.).

Hyoscyaminæ Sulphas (U. S. P., B. P.).—Hyoscyamine Sulphate. Dose, 0.0003 to 0.0006 Gm. (or gr. $^1/_{200}$-$^1/_{100}$).

Extractum Hyoscyami Viride (B. P.).—Green Extract of Hyoscyamus. Dose, 0.13 to 0.5 Gm. (or gr. ii-viij).

Succus Hyoscyami (B. P.).—Juice of Hyoscyamus. Dose, 2 to 4 c.cm. (or f3ss-j).

Pilula Colocynthidis et Hyoscyami (B. P.).—Pill of Colocynth and Hyoscyamus (compound pill of colocynth, 50 Gm.; extract of hyoscyamus, 25 Gm.). Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Pharmacology.—The dried leaves and flowering tops (B. P., the fresh leaves, flowers, and branch) of Hyoscyamus niger (Solanaceæ), collected from plants of the second year's growth, yielding, when assayed by the United States Pharmacopœia process, not less than 0.08 per cent. of mydriatic alkaloids. The chief constituent is an alkaloid, **Hyoscyamine**, which is either amorphous, or in tufted crystals, yellowish or colorless; dissolves readily in alcohol, ether, chloroform, and benzin. Hyoscyamine is also very soluble in water; with acids it forms permanent, crystallizable salts. It is isomeric with atropine, and is probably identical with daturine and duboisine. **Hyoscine** (also known as scopolamine) is very much more powerful, even 0.0001 Gm. (or gr. $^1/_{600}$) producing decided effects. Hyoscine occurs in the form of an oily, alkaline liquid, having a narcotic odor, and it is deposited from an ethereal solution in a crystalline mass. This, dissolved in solution of hydrobromic acid, yields, by slow evaporation, crystals of hyoscine hydrobromide.

The root and the seeds contain more hyoscyamine than the leaves, but their strength is more variable.

The relations of these alkaloids to atropine are thus given by A. R. L. Dohme: From hyoscyamine, Ladenburg obtained, by the action of alkalies, tropine and tropic acid, which he found identical with the substances of the same name obtained from atropine. On attempting to reunite the products from hyoscyamine, however, by means of dilute acids as he had done in case of atropine, he did not obtain hyoscyamine, as expected, but atropine. This shows that hyoscyamine and atropine are isomeric, and that the latter is the stabler form of the $C_{17}H_{23}NO_3$ molecule under ordinary conditions. If hyoscine, whose formula was believed to be isomeric with that of atropine and hyoscyamine, is treated with dilute alkalies and split up into base and acid, different products are obtained than tropine and tropic acid. Ladenburg called the base he thus obtained from hyoscine, **pseudotropine**, which means "false tropine," and gave it the formula $C_8H_{15}NO$, which is the same as the formula of tropine. Hesse has shown that this pseudotropine is not isomeric with tropine, but has the formula $C_8H_{13}NO_2$, and further that hyoscine itself is not an isomer of hyoscyamine and atropine, but possesses the formula $C_{17}H_{21}NO_4$. It hence contains two hydrogen atoms less and one oxygen atom more than they. Hesse finds that when pure hyoscine is saponified by means of dilute alkalies, it yields the compound $C_8H_{13}NO_2$, which he calls oscine, and tropic acid according to the equation:—

$$\underset{\text{hyoscine}}{C_{17}H_{21}NO_4} + H_2O = \underset{\text{oscine}}{C_8H_{13}NO_2} + \underset{\text{tropic acid}}{C_9H_{10}O_3}.$$

The tropic acid gradually changes under the influence of the dilute alkali into atropic acid by losing a molecule of water, thus:—

$$\underset{\text{tropic acid}}{C_9H_{10}O_3} = \underset{\text{atropic acid}}{C_9H_8O_2} + H_2O.$$

While the alkaline hydroxides at higher temperatures or by continued action will cause this decomposition of the hyoscine, the alkaline carbonates and ammonia will not, and at ordinary temperatures and during the ordinary manipulation of an assay, even the alkaline hydroxides will not decompose the hyoscine or other mydriatic alkaloids. Ladenburg had obtained hyoscine in 1880 as an uncrystallizable syrup from belladonna and henbane, but Bender in 1889 obtained it in crystals from the root of the plant Scopola atropoides, and gave it the name of **Scopolamine.** It also occurs in sensible amount in henbane-seed, and in some kinds of duboisia-leaves, as well as in small amount in stramonium-seed, belladonna-root, and perhaps also in other plants. Scopolamine occurs in the form of large, transparent crystals, but slightly soluble in water, readily soluble in alcohol, ether, and chloroform. Scopolamine unites with acids and the halogen bodies to form salts. Some differences between the physiological action of hyoscine and scopolamine are accounted for by Hesse, who found in commercial scopolamine hydrobromate an admixture of a small proportion of **atroscine** ($C_{17}H_{21}NO_4$): a base isomeric with hyoscine. Atroscine is a strong base which completely neutralizes mineral acids, and ammonia or alkalies liberate it from its solution as salt in form of oil drops. Hesse made the hydrochlorate, hydrobromate, and hydroiodate of atroscine, all of which are soluble in and crystallize readily from water in beautiful crystals. As hyoscine and atroscine yield the same product on hydrolysis, it occurred to Hesse that it might be possible to convert hyoscine into atroscine. He had previously noticed that hyoscine in alcoholic solution loses its optical activity if alkalies are added to it, which in the light of his recent observations led him to believe that a conversion of the one into the other was possible. Schmidt has also obtained, from an optically-active scopolamine by the action of moist silver oxide, a well-crystallized base melting at 55° to 56° C. which he called i-scopolamine: *i.e.*, indifferent scopolamine. Numerous experiments, however, soon convinced Hesse that this loss of optical activity was due to a conversion of the hyoscine into oscine and tropic acid, and that in no case was any other alkaloid formed. The i-scopolamine is unquestionably identical with atroscine. The power of dilatation of the pupil of the eye of atroscine in 0.1-per-cent. solution is more rapid than that of atropine and fully as strong, and its paralysis of the optical accommodation is also more pronounced, more rapid, and more lasting. We, hence, have here an alkaloid which in all respects is superior to the generally-used mydriatic alkaloids. From the above we learn that the name scopolamine which has for some time now been in use in chemical literature and has even been adopted by, and introduced into, the German Pharmacopœia should be therefrom erased, since it is merely a mixture of hyoscine hydrobromate and atroscine hydrobromate, and not a chemical compound.[1] The United States Pharmacopœia, although it introduced the title scopolaminæ hydrobromidum in the last revision, explains that it is chemically identical with hyoscinæ hydrobromidum.

[1] *Druggists' Circular*, Oct., 1896.

Physiological Action.—The effects of hyoscyamus are similar to those of belladonna and stramonium, but it is more calmative and less irritant. The delirium occasioned by it is not accompanied by hyperæmia. It is sedative in painful affections of the genito-urinary organs, and exerts a mild diuretic effect. Hyoscyamus occasionally gives rise to a bright scarlatiniform rash similar to that produced by belladonna. It is carminative and laxative to the digestive tract. Hyoscyamine and, to a greater degree, hyoscine are appropriate as hypnotics to disordered conditions of the mind accompanied by cerebral hyperæmia. They lower the pulse-rate and frequency of the respirations. The heart is slightly depressed; the respiration finally is paralyzed.

Professor Kobert, of Dorpat, determined that hyoscine reduced appreciably the electrical excitability of the brain. The symptoms of hyoscyamus poisoning are analogous to those produced by belladonna, and are treated in the same manner. J. N. Roussel has noted in two cases a peculiar effect upon the gustatory sense after the administration of ordinary doses of hyoscyamine ($^1/_4$ mg., or gr. $^1/_{250}$). The patients (hysterical subjects) complained that the hyoscyamine granules produced such a disagreeable taste, like asafetida, in the mouth that they could not continue them. This effect was, on further investigation, not produced either by atropine, or by tincture of belladonna or hyoscyamus given separately.

Therapy.—In painful affections of the bladder, hyoscyamus exerts a soothing influence, when administered either by the mouth or in suppositories. Decided relief is given by hyoscyamus in incontinence of urine due to irritability of the bladder and in vesical tenesmus. Dyspnœa and tumultuous action of the heart, dependent upon valvular disease, are materially relieved by the exhibition of hyoscyamus. In colic of various kinds and in constipation it is beneficial, especially to correct the drastic effects of purgatives. Hyoscyamus has been given with advantage in chronic gastric catarrh.

In the pains of locomotor ataxia, and in tremor, hyoscyamus is very efficient, as it is also in delirium tremens and the delirium of fever. Irritative cough, asthma, or whooping-cough is sometimes markedly improved by it. The antispasmodic action of hyoscyamus renders it of avail in the management of chorea and hysterical convulsions.

In nervous cough the following prescription will often be found of service:—

℞ Tinct. hyoscyami	15	c.cm. or fʒss.
Syrup. pruni Virg.	105	c.cm. or fʒiiiss.

M. Sig.: Dessertspoonful every third or fourth hour.

Hyoscyamus is capable of ameliorating painful maladies, such as neuralgia (especially visceral neuralgia), herpes zoster, and dysmenorrhœa. In these affections hyoscyamus may be combined with opium in order to counteract the constipating effects of the latter, or may substitute that remedy when peculiar susceptibility to its action exists.

Hyoscyamus excels belladonna and stramonium in hypnotic effect, and is consequently useful when a remedy of this character is required by children, by whom it is remarkably well borne. On the contrary, it is not well supported by aged people. In the insomnia of drunkards, hyoscyamine may be given, either as the fluid extract; or hypodermically, as sulphate of hyos-

cyamine, or hydrobromide of hyoscine, in doses of 0.005 0.01 Gm. (or gr. $^1/_{12}$-$^1/_6$). A soothing external application may be made (leaves, 2; flaxseed meal, 6; boiling water, 20) and employed for the reduction of swellings and the relief of the pains of sores.

Professor Verneuil mentions a case of obstinate neuralgia which was cured by hyoscyamine, after resection of nerves and amputation had failed to afford relief. Mr. Embleton has found a combination of hyoscyamine and strychnine very useful in seasickness. But it is in asylum practice that the best results from its use have been obtained. Chronic mania and delusional insanity derive benefit from it. Ringer records a case where 0.065 Gm. (or gr. j) of amorphous hyoscyamine was given in acute mania, and it quieted the patient and produced sleep; but he considers it useless in delirium tremens. Hyoscyamine separates from ether in an amorphous form, which is considerably less potent than the crystalline alkaloid obtained from solutions in chloroform. Amorphous hyoscyamine may be given from 0.01 to 0.065 Gm. (or gr. $^1/_6$-j). Ringer expressly states, however, that the maximum dose causes sleep so deep and paralysis so marked as to be alarming, and that smaller doses should be preferred. As a rule, much smaller doses are efficient in acute mania than in the exacerbations of chronic mania.

A case has been reported by Dr. Hugh Hagan, of Atlanta, in which alarming symptoms followed the administration of a single dose of 0.0027 Gm. (or gr. $^1/_{24}$) of Merck's hyoscyamine. The patient was a man, 57 years of age, suffering from paralysis agitans. An hour after taking the drug he became dizzy, lost his sight entirely, and subsequently complained of severe headache, with soreness of the throat and tongue. The face was flushed and he was much prostrated. The pulse was regular, respiration slightly accelerated, and there was considerable mental confusion. Subcutaneous injection of 0.015 Gm. (or gr. $^1/_4$) of morphine and a little whisky relieved the manifestations within a few hours.

The amorphous hyoscyamine of commerce contains an admixture of hyoscine, and confusion has arisen, therefore, as regards the proper dose. Some authorities have asserted that the amorphous hyoscyamine has a much more powerful action than the crystalline form. On account of this uncertainty of composition, danger is avoided by using only the salts such as hyoscyamine hydrobromide or sulphate, or hyoscine hydrobromide.

Hyoscyamine has also proved of great value in recurrent mania. Murrell has found it of good service in chronic dementia, with agitation and destructiveness. It diminishes the number and violence of the attacks in epileptic mania. Hyoscine hydrobromide produces similar results in much smaller doses (0.0013 Gm., or gr. $^1/_{50}$, by the mouth; 0.0006 Gm., or gr. $^1/_{100}$, hypodermically). Both of these agents have mydriatic effects, and can be used in ophthalmic practice to dilate the pupil; but duboisine is equally efficient and less expensive for this purpose, and homatropine hydrobromide safer and more reliable. Hyoscyamine in crystals is an excellent mydriatic, although amorphous hyoscyamine has been known to have an irritant effect. In exceptional instances, hyoscyamine sulphate provokes painful spasm of the ciliary muscle. The contraction may be overcome by repeated instillations of the remedy until paresis is obtained. In cases of great nervous excitement and insomnia, Prof. S. B. Howell reported to the author that hypodermic injections of from 0.0004 to 0.0008 Gm. (or gr. $^1/_{150}$-$^1/_{80}$) of hyoscine hydrobromide were usually followed, a few moments after administration,

by calm slumber. Sleep generally continued for several hours, with no ill effects, as a rule, upon awakening. Slight mental disturbance was occasionally observed as the patient awakened, but even this condition rapidly disappeared. Howell further states that injections of hyoscine hydrobromide have never failed him, in cases which had been upon the protracted use of morphine. Hyoscine hydrobromide may be used with advantage in doses of 0.0006 Gm. (or gr. $^1/_{100}$) to allay the convulsions of cerebro-spinal meningitis. Hyoscine has been successfully used also for the purpose of checking spermatorrhœa.

A toxic dose of hyoscine hydrobromide causes a rapid development of vertigo, followed by sleepiness, loss of consciousness, and stupor. In a number of cases death has followed the combination of hyoscine with morphine, when given hypodermically.

Malfilatre and Lemoine, after the use of hyoscine in sixty-two patients, most of whom suffered from some form of insanity, conclude that it is an excellent remedy in all conditions of insomnia with agitation. In some individuals it produces a temporary intoxication. In others the dose must be constantly increased in order to maintain the hypnotic effects.

Hyoscine or **scopolamine hydrochloride** in ophthalmological practice, according to the estimate of Raehlmann, is about five times as powerful as atropine. It is used in $^1/_{10}$- to $^1/_5$-per-cent. solutions; of the latter 0.37 or 0.43 c.cm. (or *m*vi-vij) may be administered daily to an adult or used every fifteen minutes during an hour and a half. Weaker solutions are employed in the case of children. (See **Scopolamine Hydrochloride.**)

HYPNAL.—Monochloral-antipyrin. Chloral forms two definite crystalline combinations with antipyrin: mono- and bi- chloral-antipyrin. The first is known as hypnal, which is an oily liquid with an ether odor and chloral taste.

Physiological Action and Therapy. — Dr. Schmidt, of Nancy, found that 1 c.cm. (or *m*xv) is equal to about 0.50 Gm. (or gr. viiss) of chloral as an hypnotic; upon respiration it is about equal, while upon arterial pressure and cardiac contractions it has less effect than chloral alone. In the stomach it is more poisonous than the amount of chloral contained in it. In the alimentary tract it is split up into its two constituents.

Dr. Fraenkel prefers it to chloral because it is nearly tasteless, is devoid of qualities irritating to the mouth or stomach, and considers it an unrivaled soporific, especially when insomnia is the result of pain. It is sparingly soluble, and is given suspended in mucilage, in capsules or cachets. Mattison writes[1] that he regards hypnal as particularly adapted to children and to patients with phthisis, lessening fever, pain, insomnia, and unrest. He recommends the following formula of hypnal:—

℞ Hypnal ..... 1 | c.cm. or *m*xv.
Alcoholis ..... | 67 c.cm. or *m*xj.
Elixiris vel syrupi ..... ad 15 | c.cm. or f℥ss.

M. Sig.: One dose; to be followed by one-third of a tumbler of water.

HYPNONE.—Phenyl-methyl-ketone, Benzoyl-methide. Hypnone is a colorless fluid, insoluble in water or glycerin, and possesses an aromatic odor.

[1] *Medical Record.*

Hypnone is very soluble in alcohol, ether, chloroform, benzin, and certain oils,—as the oil of sweet almonds. It has been hypodermically employed. It is preferably administered in capsules. It has some hypnotic power, and is eliminated by the lungs and kidneys. In large doses it causes coma and paralysis of heart and respiration. Hypnone is thought to be especially adapted to the insomnia of alcoholism, and is likewise regarded as an excellent sedative in mental affections and nervous insomnia in doses of 0.30 to 0.60 c.cm. (or *m*v-x).

HYSSOPUS.—**Hyssop,** the herb Hyssopus officinalis (Labiatæ), contains about $^1/_2$ per cent. of a volatile oil, with tannin and a bitter principle. It is stimulant, carminative, and sudorific, and is given in solid or fluid extract in stomach disorders, recent colds, etc.

HYSTERONICA. — **Hysteronica,** or **Haplopappus.** The Hysteronica Baylahuen (Compositæ) is a native of South America. It is a perennial plant with oval leaves; bears a yellow flower; contains an ethereal oil having the specific odor of the plant, a greenish-black resin (also of the same odor), gum, and glucose. The resin is excreted by the kidneys, the oil by the lungs. Dr. G. Baillé[1] reports that the infusion is an excellent remedy in diarrhœa and it has produced good results in acute and chronic dysentery.

It has also been proved useful in the diarrhœa of phthisis or cancer. Hysteronica allays inflammation of the bronchial mucous membrane, lessens expectoration, and quiets cough without causing sickness of the stomach. It promotes the action of the kidneys and diminishes the offensive odor of the urine in vesical catarrh. This remedy increases the acidity of the urine, seems to be without effect upon the perspiratory glands, and assists the healing of wounds. It may be used as a vehicle for remedies like the mercurials in order to prevent the production of diarrhœa. Given in alcoholic tincture, it does not produce constipation.[2] The tincture is made by macerating 100 parts of the drug in 500 parts of 90-per-cent. alcohol for ten days, and its dose is from 1 to 2 c.cm. (or *m*x-xxx). A fluid extract in doses of 1.33 c.cm. (or *m*xx) is given in milk, or almond emulsion, three times or more daily, for chronic dysentery .

ICHTHYOCOLLA.—**Isinglass (Fish Glue).**

Preparation.

Emplastrum Ichthyocollæ.—Isinglass-plaster, Court-plaster.

Pharmacology.—"The swimming bladder of Acipenser Huso and of other species of Acipenser (class, Pisces; order, Sturiones)"; or, more definitely, the inner membrane of the swimming bladder, which is generally spread out in drying, forming flat sheets, or *leaf-isinglass.* The kind imported from Russia is the most valued. Chemically, it is an exceptionally pure gelatin, known to chemists as glutin; it is free from odor and taste, and is soluble almost without residue in boiling water and in boiling diluted alcohol. Isinglass does not dissolve in cold water, as gelatin does, and, therefore, is a valuable constituent of cements. Both are precipitated by tannin.

Therapy.—Isinglass is used for clarifying infusions, and may be boiled

[1] Paris letter, *Therapeutic Gazette,* Sept., 1890, p. 640.
[2] *Therapeutic Gazette,* vol. xiii, p. 287.

with milk for internal use in bowel disorders. A codliver-oil jelly is made by means of isinglass, according to the formula given by Dr. Whitla in his excellent work on Materia Medica:—

℞ Olei morrhuæ	150	c.cm.	or f℥v.
Ichthyocollæ	8	Gm.	or ʒij.
Pulv. sacch. alb.	46	5 Gm.	or ʒiss.
Olei amygd.,			
Olei pimentæ	aa	24 c.cm.	or *m*iv.
Olei cinnamomi		18 c.cm.	or *m*iij.
Aquæ	30	c.cm.	or f℥j.

M. This preparation is taken readily by children, and can be given in teaspoonful doses, alone or in milk, orange-juice, etc.

The well-known court-plaster, spread on silk, affords a convenient method of approximating small wounds and excluding the air; the addition of an antiseptic, like salicylic acid, is an improvement, forming salicylated isinglass-plaster.

ICHTHYOLUM.—Ichthyol is the **Ichthyosulphonate of Ammonium** or **Sodium.** A mineral deposit found in the Tyrol, of a bituminous character, yields, upon distillation, a tarry-looking substance called ichthyol, so named from the fact that the deposit appears to be the fossil remains of fishes. It is purified by distillation and with sulphuric acid. Ichthyol has a decided fishy odor, which to some is very unpleasant. The odor may be disguised by the addition of 10 per cent. of the oil of citronella, or by a mixture with coumarin. It is faintly alkaline, and contains a resin and 10 per cent. of sulphur in the form of a sulphur acid. It is soluble in a mixture of alcohol and ether, readily mixes with ointment and fats. It is generally used in a 10- to 20-per-cent. ointment. A synthetically prepared ichthyol is supplied under the trade name, **Thiol.**

Physiological Action and Therapy. — Ichthyol applied externally, as well as when internally administered, acts similarly, in many respects, to sulphur and tar. The resin contained in ichthyol, makes it exceedingly objectionable for external application on account of the sticky or gummy deposit left upon the skin. According to the experience of the author, ichthyol is irritating to the integument of many, and is poorly absorbed in the majority of cases. Ichthyol given internally has, in some instances in the writer's experience, occasioned more or less gastro-intestinal irritation, followed by diarrhœa. Dr. A. Stacquart, of Brussels, has reported several cases of gastro-intestinal difficulties attended by various nervous manifestations in which he found the internal administration of ichthyol very useful. He gave the drug in the daily dose of 0.005 c.cm. (or $m^1/_{12}$). It is said to check the elimination of albumin in Bright's disease and to be useful in pyelonephritis.

The free application of a 20-per-cent. ointment caused narcotism and stupor in a child, followed, however, by recovery. In the case of a woman whose endometrium had been curetted on the preceding day, Bergerio saw a rapid pulse and general depression, which continued for about twelve hours, follow the injection into the uterine cavity of a solution containing one-third of ammonium ichthyol to two-thirds of glycerin.

Unna considers ichthyol the best agent for treating certain chronic skin diseases, especially eczema and psoriasis. A 20-per-cent. ointment is sometimes useful in acute erysipelas, and also for the pain and swelling of the

joints accompanying acute rheumatism. Ichthyol has been applied to furuncles, exudative erythema, intertrigo, herpes zoster, gout, and neuralgia. It is said to relieve the pain and promote the healing of cracked nipples.

Dr. Ramón Guitèras, of New York, states that a 50-per-cent. ointment has given him better results than any other counter-irritant in gonorrhœal rheumatism. Ichthyol ointment has been employed in chronic eczema, acne, urticaria, lupus, and keloid. Dr. Agnew indorsed its value in enlargement of lymphatic glands, and it acts well at times as an application in chilblains and burns.

Ichthyol has been extensively used in gynæcological practice. It has been found of service in cervical and corporeal endometritis, perimetritis, and parametritis. It promotes the rapid absorption of recent exudates. Dr. Richard Bloch esteems it particularly valuable in the treatment of painful inflammatory diseases. Ichthyol exerts a good effect upon acute gonorrhœal and non-specific vaginitis, in which it manifests also a decided astringent influence upon the vessels. Jadassohn applied with advantage a 10-per-cent. ointment of ichthyol in gonorrhœal catarrh of the cervix. The injection of a 2- to 5-per-cent. aqueous solution is beneficial in gonorrhœa of the male, diminishing the discharge, relieving the pain, and preventing the chordee. A $^1/_2$- to 1-per-cent. solution may be employed to wash out the bladder in cases of cystitis. Dr. Scharff alleviated the pain and reduced the swelling and inflammation of the prostate by the injection of a 10-per-cent. watery solution into the rectum.

Unna advises the combined external and internal employment of ichthyol in leprosy, and several cases have been reported in which this method was of considerable apparent benefit. Dr. Ohman Dumesnil,[1] of St. Louis, reported a case of the tuberculo-anæsthetic form, in a woman, cured by drachm doses given three times a day. The remedy has been used in smallpox in order to prevent pitting. Dr. Lorenz has found an ointment containing 1 to 10 per cent. of ichthyol serviceable in acute coryza and all kinds of inflammation involving the mucous membrane and skin of the nose.

Thiolinic Acid.—This substance is prepared from a sulphurated linseed-oil by treating with sulphuric acid, and occurs as a thick, dark-green, viscid mass, which is insoluble in water and soluble in alcohol. It contains 14.2 per cent. of sulphur, principally in organic combination. Thiolinic acid combines with alkaline bases, and its salts are soluble in water. The acid has a faint odor, which resembles that of oil of mustard. The salts are without odor. It is thought that thiolinic acid will prove to be an efficient substitute for ichthyol.

Ichthalbin, a combination of ichthyol with albumin, is tasteless and odorless and free from most of the objections against ichthyol, and is used as a substitute for the latter as a dusting-powder. Dr. Samuel Wolfe employs compressed tablets (of each, 0.32 Gm., or gr. v) in diphtheria and various chronic and subacute affections of the mucous membranes of the alimentary, respiratory, and genito-urinary tracts; from 10 to 12 of these tablets were administered daily, with good effect. In florid and inflammatory dermatoses, it is one of the best internal remedies, according to Wolfe. It is a valuable intestinal antiseptic, and is preferable to ichthyol for internal use.

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[1] *Jour. Amer. Med. Assoc.*, June 13, 1903, p. 1635.

Ichthargan is sulphichthyolate of silver, and it is alleged that it possesses antiseptic power equal to silver nitrate. It is decomposed when taken into the stomach, forming ichthyol. Injected into the blood, it acts like silver nitrate; but is less poisonous. It causes central motor paralysis of the heart. In 1-per-cent. solution in glycerin and water, is useful for gonorrhœa and vaginitis applied as a compress.

IGNATIA. — Ignatia, Bean of St. Ignatius. The seed of Strychnos Ignatii (Loganiaceæ) contains two alkaloids, both highly poisonous, **Strychnine** and **Brucine** (from 0.5 to 1.5 per cent. of each). Strychnine and its salts are official. (See **Nux Vomica.**)

ILEX.—Holly. The leaves of several American species of Ilex contain **Caffeine**, and may be used as substitutes for the Camellia thea. In the Southern United States the Ilex cassine (Aquifoliaceæ) is used in this way to some extent, but the Brazilian holly, Ilex Paraguayensis, is much richer in caffeine, and is extensively used in South America, in recent infusion, where it is known as maté, or Paraguay tea. The maté is the gourd, in which the infusion is made by pouring upon the leaves successive quantities of boiling water. The following analysis will show the analogy and the slight differences between the ilex and tea and coffee; it was made by Dr. T. Cranstoun Charles:—

	Caffeine. Percentage.	Tannic Acid. Percentage.	Ash. Percentage.
Tea	3.10	22.70	5.80
Roasted coffee	1.20	5.80	4.60
Maté	0.79	21.90	4.10

Besides these constituents there are small amounts of volatile aromatic oils, empyreumatic products, etc., which modify the effects of each upon the system, and upon different individuals. In the main, however, the effects of maté are those of caffeine.

Physiological Action and Therapy.—Dr. Charles found holly stimulant to the brain and also to the sympathetic system; the contractions of the muscular tissue of the heart and of the bladder and intestines were increased, and the whole muscular system stimulated to increased labor and wakefulness. Ilex augments the flow of urine and amount of urea and phosphoric acid. At present its therapeutic applications seem limited to the treatment of headaches accompanied by constipation, especially when tea and coffee do not agree.

ILLICIUM.—Illicium (Star-anise).

ANISI STELLATÆ FRUCTUS (B. P.).

Pharmacology and Physiological Action.—The Illicium verum (Magnoliaceæ) is a native of China and Siam; its fruit, which is official, contains a pleasant aromatic volatile oil resembling that of anise, and also some fixed oil. Two spices, I. Floridanum and I. parviflorum, are natives of this country, being found in Florida and adjacent States. The Japanese variety, Illicium religiosum, contains a much smaller quantity of the oil, besides a crystalline substance called *sikimin* or *shikimi*, which is poisonous; so that dangerous results have followed the substitution of the latter for the former, such as violent epileptiform convulsions with cyanosis, ending in death. Illicium-oil is often substituted for the oil of anise; and, in fact, it is said

to be the chief source. Dr. E. Barral has isolated a poisonous glucoside from the kernel of Illicium parviflorum, which is not in the pericarp. The decoction of the seed, if the dose be sufficiently large, produces attacks of gastric irritation and vomiting, followed by paralysis, anæsthesia, convulsions, and death.

Therapy.—The medicinal virtues are similar to those of anise and other carminatives. The crushed seeds are sometimes popularly applied externally to allay the pain of earache, colic, rheumatism, etc. It also has some reputation in Germany in the treatment of bronchitis, prepared as a tea, although this form of administration is not recommended.

INDIGO.—Indigo is a vegetable coloring agent, obtained from several species of Indigofera (Leguminosæ) of India. It is prepared from the juices of these plants by macerating the green twigs and leaves and developing a kind of fermentation process. It is sold in masses of a blue or purplish color, and should contain from 70 to 90 per cent. of **Indigo-blue**, or **Indigotin.** Indigo is insoluble in water and alcohol. The sulphate of indigo is a pasty mass and mixes with water, forming liquid blue. Used chiefly as a coloring agent and in solution for chemical tests.

Dr. J. L. Jones has used indigo with advantage in thirteen cases of amenorrhœa. He prescribes 64 Gm. (or ℥ij) of indigo mixed with 15.5 Gm. (or ℥ss) of bismuth subnitrate, and gave $^1/_2$ teaspoonful in water three times a day. Under its administration the urine becomes brownish green in color and acquires an offensive odor. The stools are liquid and have an obnoxious smell.

INGLUVIN.—Ingluvin. A digestive preparation.

Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Pharmacology.—Ingluvin is prepared from the gizzard of the domestic fowl. It is a soft powder, yellowish gray in color, and possesses a faint odor. It is almost devoid of taste. Ingluvin is insoluble in water and the usual menstrua; it can be administered stirred into water or milk. Ingluvin can be conveniently given to children spread upon bread and butter. The powder has the advantage of being compatible with alkalies. Its virtues depend upon the presence of a peculiar bitter principle.

Therapy.—Ingluvin is of special benefit in the relief of sick stomach. As it is free from irritant properties, it may be given with advantage when vomiting depends upon organic affections of the stomach, as acute and chronic gastric catarrh and gastric ulcer. Nausea due to disease of other abdominal or pelvic viscera,—as the liver, kidneys, uterus, and ovaries,—is likewise relieved by the administration of this remedy. Ingluvin allays the gastric irritability which accompanies tabes mesenterica and marasmus.

It has been found of service in relieving vomiting produced by the abuse of alcoholic liquors. It is of advantage in seasickness and in the relief of the gastric irritability of bottle-fed babes. In the vomiting of pregnancy it approaches the character of a specific. Ingluvin is beneficial in dyspepsia when produced by functional inactivity. It checks diarrhœa caused by indigestion. By reason of its influence upon the stomach and bowels it is of service in cases of cholera infantum and cholera morbus.[1]

[1] See paper by author on "The Clinical Application of Ingluvin" in the *Medical Bulletin*, June, 1893.

INULA.—Inula (Elecampane).

Dose, 1 to 4 Gm. (or gr. xv-3j) in infusion.

Pharmacology.—"The root of Inula helenium (Compositæ)" contains **Helenin, Alantic anhydride,** and **Alant-camphor,** all crystalline bodies, and **Alantol,** a yellow liquid. Alant-camphor, in taste and smell, suggests peppermint. It is difficult to isolate these substances in quantity, and the alantic anhydride probably differs from helenin only in being less oxidized. Helenin presents itself in the form of colorless crystals, free from odor, insoluble in water, soluble in boiling alcohol, ether, and oils. Alantol is a yellowish, oily fluid, having an odor and taste resembling that of peppermint, soluble in alcohol and boiling at 392° F.

The substance which has lately been used to some extent in medicine under the name of helenin appears to consist of a combination of the camphor, the anhydride, and helenin proper. Elecampane also contains some bitter extractive, and about 20 per cent. of **Inulin,**—a peculiar kind of starch not colored blue by iodine. Inulin occurs in the form of a white crystalline powder. It is hygroscopical, without odor or taste, slightly soluble in water, insoluble in alcohol, and, chemically, appears to be the anhydride of lævulose. C. Tanret has separated two substances resembling inulin, which he designates as pseudo-inulin and inulenin.

Physiological Action.—The active principles of elecampane have been the subject of an investigation by Mr. T. J. Bokenham.[1] Korab, in 1885, had found that the drug inhibited the development of tubercle bacilli, while Baeza stated that, added to the urine, it prevented putrefaction; that it diminished all the secretions, but especially those of the trachea and larynx. In small doses it was said to prevent the sialagogic and diuretic action of jaborandi. Bokenham has demonstrated that any of the crystalline constituents of elecampane will prevent the growth of the tubercle bacillus, if present even in the proportion of 1 to 10,000. The result was the same in the case of all the solid nutrient media usually employed in bacteriological experiments. Liquid media containing large quantities of bacilli in suspension become, upon addition of helenin, incapable of producing tuberculosis, or even an enlargement of the nearest lymphatic glands, when inoculated into healthy guinea-pigs. In studying its effects upon other organisms, Bokenham found that rapidly-growing microphytes were practically unaffected by the presence of even 1 part of the drug in 1000 of the nutrient medium. On the other hand, the streptococci pyogenes, streptococci erysipelatis, and bacillus typhosus refused to grow on these prepared media. In experiments upon guinea-pigs no ill effect was produced by the drug itself, however great the daily dose administered. In no case was the course of the disease following inoculation with virulent material arrested, although it was considerably retarded. The writer cited does not consider himself justified in stating that any one of the constituents of elecampane-root possesses greater value than the mixed product. Marpmann states that the excretion of urine and uric acid is increased by inula, and he, therefore, suggests that it may prove useful in chronic gout.

Therapy.—From its influence upon tubercle bacilli, it is possible that helenin may prove useful in the treatment of tuberculosis. A few clinical experiments have been made, but not sufficient to warrant any decisive conclusions as to the results.

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[1] *British Medical Journal,* Oct. 17, 1891.

Good effects have been reported from its use in malaria, catarrhal diarrhœa, whooping-cough, and chronic bronchitis. On account of its antiseptic properties, powdered helenin has been employed as a surgical dressing with alleged benefit. Helenin is said to exercise a favorable influence also upon tuberculous diarrhœa.

Hamonic has reported very good results from the use of helenin in uncomplicated leucorrhœa. Applied locally, it irritates the vaginal mucous membrane, but, given by the mouth, it exerts a special influence upon the glands of the cervix uteri. A few doses cause the disappearance of the glairy discharge of catarrhal endometritis. Hamonic has given the drug in the form of a pill containing about 0.01 Gm. (or gr. $^1/_6$) of crude helenin, two to four pills to be taken in the twenty-four hours.

Inulin has been used, in the dose of 0.065 to 0.13 Gm. (or gr. i-ij), in dyspepsia and chronic pulmonary affections. An inulin bread has been prepared for the use of diabetic patients. This principle has also been administered in whooping-cough.

Alantol has been given in the dose of 0.01 to 0.02 Gm. (or gr. $^1/_6$-$^1/_3$), repeated every hour or two, in chronic bronchitis and pulmonary tuberculosis.

The powdered root of elecampane is used in decoction (15.5 Gm. to 473 c.cm., or ℥ss-Oj), sweetened and flavored, which is taken freely as a diaphoretic and expectorant in chronic bronchial and pulmonary affections, dyspepsia, dysmenorrhœa, etc. It has been used, both internally and externally, in eczema and psoriasis.

IODOFORMUM (U. S. P., B. P.).—**Iodoform** (CHI_3).
Dose, 0.13 to 0.32 Gm. (or gr. ii-v).

Preparations.

Unguentum Iodoformi (U. S. P., B. P.).—Ointment of Iodoform (10 per cent.).
Suppositoria Iodoformi (B. P.).—Iodoform Suppositories (0.2 Gm., or gr. iij).

Pharmacology.—Iodoform was discovered by Serullas in 1822, and introduced into medicine in 1837 by Bouchardat, and also by Dr. R. M. Glover, of London. It is produced by the action of iodine in the presence of alkalies upon alcohol, aldehyde, ether, acetic ether, acetone, lactic acid, and in minute quantities carbohydrates or proteid compounds. It occurs in yellow, scaly crystals, which are insoluble in water, but soluble in alcohol, ether, and the fixed and volatile oils. By a temperature of above 239° F. it is fused, giving off violet vapors, and finally decomposes into iodine and hydriodic acid. Iodoform is obtained from the ash of sea-weed in France. It may be made by subjecting a hydroalcoholic solution of potassium iodide to electrolysis, while a current of CO_2 is passing through the liquid. Filhol's process consists in adding iodine to a warm mixture of sodium bicarbonate, alcohol and water. It is volatile and should be kept in well-stoppered bottles, in a cool and dark place.

Iodoform has a sweetish taste and a peculiar, penetrating odor, which adheres persistently to the vessels in which preparations of it have been made, and to the clothing and hands of those who use it. Many attemps have been made, with indifferent success, to mask the peculiarly offensive odor of this substance. The essential oils, balsam of Tolu or of Peru, Tonka bean, menthol, eucalyptol, thymol, naphthalin, tar, and creolin have all been used for

this purpose. Lindermann's mixture consists of iodoform, 1; balsam of Peru, 3; and vaselin, 8 parts. Instead of vaselin, 12 parts of alcohol, glycerin, or collodion may be employed. Pulvis iodoformi dilutus (N. F.) contains iodoform, 2; boric acid, 3; naphthalin, 5 parts, with oil of bergamot q. s. It is a fine powder, and the odor is entirely masked. The iodoformum aromaticatum (N. F.) contains 4 per cent. of coumarin. Other expedients which have been suggested are the addition of a small quantity of the oil of citronella or mixture with recently-ground coffee. One of the best is that discovered by Shufelt, of dissolving the iodoform in the volatile oil of camphor. This combination was used both as an ointment and a paste. If preferred, the odor of camphor can also be removed by the admixture either of oil of bitter almonds or of Canada balsam. According to Pagenkopf, the addition of a small quantity of Russian turpentine-oil imparts a peculiar and not unpleasant odor. Klingmann endeavors to accomplish the same purpose by preparing a solution of iodoform in olive-oil. He adds 1 part of iodoform to 6 parts of olive-oil, and shakes for twelve hours. The clear, saturated oil filtered off contains about 3 per cent. of iodoform.

The odor of iodoform may be removed from utensils or the hands by washing with a watery solution of tannic acid. Dr. W. Washburn, of New York, points out that, as chloroform and ether are solvents of iodoform, they may be successfully used in order to remove the odor of that substance from the hands, nails, and clothing. Bienert states that washing the hands once or twice with flaxseedmeal in water causes rapid disappearance of the odor of iodoform. Oil of turpentine is also a good solvent.

The use of iodoform has been almost abandoned since odorless substitutes have been introduced.

Physiological Action.—Applied to the sound skin, to mucous membranes, or to ulcers, pure iodoform (although containing 29 out of 30 parts of iodine by weight) is not irritating, but, on the contrary, blunts sensibility and acts as a local anæsthetic. Exceptions to this rule, however, occasionally occur. Dr. Edward Martin has, for instance, reported five cases of leg-ulcers which were decidedly aggravated by the use of iodoform as a dusting-powder. In two cases observed by Hahn, a vesicular eruption followed the topical use of this drug, and a case of generalized urticaria, due to the local use of iodoform, has been reported by Dr. C. H. Powell, of St. Louis, Mo. Commercial iodoform has been found to be adulterated with picric acid and other substances, which may explain some of the unexpected results.

Internally, in doses up to 0.32 to 0.38 Gm. (or gr. v-vj), it produces no symptoms, except slight increase of appetite; iodine appears in the urine and saliva within two hours and traces continue for several days. In larger doses, iodoform produces decided narcotic effects in dogs, with inco-ordination and staggering, convulsions, and death. In man, poisonous effects have followed its very free use in wounds, the principal symptoms being prostration, headache, faintness, and persistent iodoform taste in the mouth. The temperature is affected, being increased to 104° F. or more; the pulse becomes soft, feeble, and rapid. The face may be flushed, the pupils contracted, and the respiration stertorous. Delirium and suicidal mania have also been noticed. Several cases of death have been caused in this way, preceded by great anxiety and restlessness and sudden collapse. In a few instances amblyopia has

been observed in consequence of the absorption of iodoform. Mr. Priestley Smith has described the case of a patient in whom toxic amblyopia developed after having taken 64.5 Gm. (or gr. m) in forty-one days. A fatal case is reported[1] in a woman in good health, who died of iodoform poisoning. On the left leg there was a small varicose ulcer which had been dressed with iodoform powder. After this treatment tumefaction set in and the leg became red and painful, and at the end of eight days there was a generalized eruption, which was manifestly due to the action of the iodoform. On the legs, the thighs, and the body the exanthem was like that of measles; on the arms and the buttocks it was characterized by a very diffuse scarlatinous redness. On the red ground of the eruption there was a great number of small, miliary vesicles, which were detached and contained a lemon-colored liquid. She suffered greatly; her face was red and tumefied, and there was profuse lacrymation, but no fever. The general condition rapidly became worse, the face pale and drawn, and albumin was found in the urine. Dyspnœa and weakness became progressive, and, in twenty days after the onset of the symptoms, death occurred. Some years before the patient had had a similar eruption following upon the employment of an iodoform dressing.

A simple test for iodoform intoxication has been suggested. A test is made of the urine to note the quantity of iodine eliminated by it. A small pinch of powdered calomel is placed upon a white saucer, and then a few drops of the urine to be examined are dropped upon it; a mixture of urine and calomel is then made with a glass rod. If the urine contains a notable amount of iodine there is produced a well-marked yellow discoloration, which should indicate that the iodoform is being absorbed in sufficient quantity to produce danger.

In cases of death from this substance the kidneys, liver, heart, and voluntary muscles have been found in a state of fatty degeneration. There is no doubt that in some patients an idiosyncrasy exists with regard to iodoform, just as there is with regard to the other iodides. In a case witnessed by Demme, chorea appeared as one of the manifestations of iodoform poisoning. A severe general dermatitis, followed by desquamation and accompanied by a profuse diarrhœa, was observed by Kloman in consequence of the application of iodoform to a chronic leg-ulcer. Urticaria has been witnessed as a result of the external use of iodoform, and its administration internally has been known to produce a purpuric eruption.

The first step in the treatment of toxic symptoms is the prompt removal of the iodoform from the body in order to prevent further absorption; in many cases this is all that is necessary. As remedial agents, stimulants are required, and elimination favored, by sponging the skin frequently with warm water and alcohol, and the administration of mild diaphoretics. It is especially advised that iodoform should not be used with carbolic acid; that only small quantities should be dusted over the wound; that close sutures and tight bandages be avoided and free drainage maintained. Some specimens of iodoform have been found to be adulterated, and this fact may have been responsible for the reported bad results as already pointed out. Potassium bicarbonate, given hourly in the dose of 0.65 Gm. (or gr. x), is said to counteract the toxic effects of iodoform.

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[1] *Revue Médicale de la Suisse Romande*, 1896, p. 431.

The potassium bromide is also regarded as antidotal, not only as a neutral potash salt, but also by virtue of its specific bromide action, and the fact that it excels all other salts as a solvent for iodoform. Iodoform escapes by the breath under its own form, and, by the urine, as iodide with a little iodate.

Therapy.—The anæsthetic and antiseptic qualities of this agent make it a useful application, especially in gunshot and infected wounds, chancroids, phagedæna, and sloughing ulcers. It acts as an antiseptic, not by destroying bacteria, but by sterilizing the soil in which they might develop, and, possibly, by neutralizing or destroying bacterial products. Either in the form of powder or the official iodoform ointment, it is valuable in bedsores, lupus vulgaris in the ulcerative stage, and enlarged or ulcerated scrofulous glands.

An antiseptic and sedative combination, praised by Cavazani, is as follows:—

℞ Pulv. iodoformi	62|	Gm. or ℥ij.
Acid. salicylici,		
Bismuthi subnitratis aa	23|3	Gm. or ʒvj.
Pulv. camphoræ	6|	Gm. or ʒiss.—M.

Iodoform constitutes a serviceable application also to syphilitic lesions. The ointment reduces inflammatory action in buboes and may prevent suppuration. It is at times attended with very good results in chronic eczema, and has been recommended in prurigo. In half or quarter strength this ointment is useful in ophthalmia and granular lids. An ointment composed of 0.065 to 0.32 Gm. (or gr. i-v) of iodoform rubbed up with 31 Gm. (or ℥j) of excipient is recommended as an effective application in pannus, corneal ulcers, trachoma, and chronic conjunctivitis.

An ointment composed of 10 Gm. (or gr. cl) of iodoform and 14.5 Gm. (or gr. ccxxv) of carbolic acid to 31 Gm. (or ℥j) of excipient is a serviceable local application in nasal catarrh, due to chronic rhinitis.

Iodoform diminishes the pain of ulcerated carcinoma. In cancer of the womb, a bolus or anodyne suppository is recommended by Ringer, containing from 0.50 to 1 Gm. (or gr. viii-xv) of iodoform, incorporated in cacao-butter. This suppository can be deposited in the cavity of the malignant ulcer. The swelling and pain of orchitis are diminished by the application of iodoform ointment. A saturated solution of iodoform in chloroform relieves the pain of neuralgia and chronic gout.

It is a useful application, in the form of ointment or soluble bougies, to the urethra in the treatment of gleet or chronic gonorrhœa. T. Thierry finds it useful in the acute stage of gonorrhœa. He injects thrice daily a mixture of 1 part of iodoform and 6 parts of oil of sweet almonds. In painful affections of the rectum and bladder, fissures, and hæmorrhoids, suppositories of iodoform containing 0.32 Gm. (or gr. v) afford great relief.

An iodoform rectal suppository is likewise recommended for the relief of chronic prostatitis, 0.30 Gm. (or gr. v), in coca-butter or gelatine.

Its solution in ether (1 to 4), kept in red-glass bottles, is a valuable agent in treating ulcers of the mouth and throat. It has been shown by P. Carles that a saturated solution of iodoform in ether is very unstable, liable to sudden decomposition, the liquid assuming a reddish color as a result of the liberation of iodine. The addition of alcohol and absence of light retard this change. Combined with tannin and triturated together,

iodoform is a good astringent for soft hypertrophies in the nose, or insufflated into the pharynx for post-nasal catarrh, and into the nasal chambers for ozæna. Finely powdered iodoform, used by insufflation, is a good application in laryngeal tuberculosis, relieving hoarseness and pain.

In order to overcome the practical difficulties in the application of powdered iodoform to tuberculous ulcers of the larynx, Dr. Siemon proposes that it be administered by inhalation. He employs a solution of iodoform in essential oils. An inhalation flask being half-filled with ordinary turpentine-oil, 0.60 to 1 c.cm. (or *m*x-xv) of an iodoform solution are added and this quantity is inhaled three or four times a day.[1] The following emulsion is recommended by L. Frey as an injection for cystitis:—

Iodoform	50 parts.
Glycerin	40 parts.
Distilled water	10 parts.
Tragacanth	25 parts.

A teaspoonful of this mixture is added to a pint of warm water, and, after being shaken thoroughly, used as an injection. The procedure is repeated every three days until four injections have been given, after which once a week will suffice. The late Professor Billroth obtained most gratifying results from the use of an iodoform emulsion in cold abscess and tuberculous caries. His mixture contains 10 Gm. (or ʒiiss) of pulverized iodoform in 100 c.cm. (or fʒiiifʒiiss) of glycerin. After most scrupulous antiseptic precautions the abscess is cut down upon and opened, the carious bone is scraped thoroughly, and the cavity in each case cleansed. The inner surface of the abscess-wall is firmly rubbed by a large pledget of iodoform gauze, the wound is then stitched up, except a large opening through which the emulsion is poured into the cavity of the abscess or the bone. Recovery sometimes takes place by the first intention. Usually a second dressing is soon required; drainage-tubes are inserted, the deep parts close by first intention, and the superficial granulating wound heals under an ointment. In other cases more suppuration occurs and recovery is less rapid, or, perhaps, the operation must be repeated. The most forbidding cases of large abscesses, with numerous fistulæ, yielded the best absolute results. He applied the same method to the treatment of echinococcic cysts, but added the caution that if the cavity is very large there is danger of iodoform poisoning. This procedure is also of value in the tuberculous joint disease of children and adults. Dr. K. Garré, of Tübingen, reports favorable results in goitre from the interstitial injection of iodoform, dissolved in olive-oil and ether.

A 4-per-cent. solution of iodoform in spirit of turpentine has been found useful, administered in the form of inhalation, for laryngeal or pulmonary tuberculosis and bronchorrhœa.

℞ Iodoform	4	Gm. or ʒj.
Ol. terebinth. rectificat.	30	c.cm. or fʒj.

Administer from 0.18 to 0.30 c.cm. (or *m*iii-v) by inhalation in phthisis and bronchiectasis with high temperature.[2]

Shufelt's combination of iodoform and volatile oil of camphor has given good results when inhaled in bronchiectasis and phthisis. Chibret states

[1] *Provincial Medical Journal*, Sept. 1, 1892.

[2] Dr. Powell, *Quarterly Bulletin of Clinical Surgery* of New York Post-graduate School.

that iodoform, freely sprinkled in the sick-room, diminishes the number of paroxysms in whooping-cough and shortens the course of the disease.

Kapper has advantageously employed injections of iodoform in the treatment of goitre. He makes use of a solution of 1 part of iodoform in 7 parts each of ether and olive-oil.

It may merely be added, in conclusion, that in children intoxication rarely ocurs as a result of the local use of iodoform, but that old people are very susceptible to its action.

For venereal sores:—

℞ Iodoform.	4		Gm. or 3j.
Ol. camphoræ	15		c.cm. or f3iv.
Acid. salicylic.	15	5	Gm. or 3iv.
Amyli	q. s.		

M. Sig.: Make a stiff paste for application to ulcerated surface.

It can also be obtained combined with dressings, as iodoform gauze, cotton, or wool, for use as tampons. When applied to the surface of the body dissolved in collodion, it reduces temperature. In cancer of the breast, iodoform in powder, or in ointment, markedly relieves pain and renders the progress of the disease slower.

Internally, iodoform has been employed as an alterative and as a means of bringing the system under the effects of iodine in phthisis, scrofulous affections, and liver disorders, but has not always fulfilled anticipations. Dr. Whitla speaks in very favorable terms of the internal use of iodoform in phthisis, confirming the reports of Dreschfeld and other writers. It is administered in pills, together with extract of gentian or other stomachic tonic. The same combination has been employed in hæmoptysis with the most satisfactory results by Chauvin and Jorisenne. They have seen it succeed where ergotin had failed. If considered judicious, tannin may be incorporated in each pill. Thus given, it creates no gastric irritation. Dr. Gavoy reports decided amelioration of tuberculous bronchitis from the hypodermic injection twice daily of a quarter of a syringeful of a solution of 1 part of iodoform in 100 parts of oil of sweet almonds. In some cases of neuralgia the internal administration of iodoform has given relief.

Some writers regard it of service in catarrhal jaundice and the early stage of cirrhosis of the liver. In constitutional syphilis iodoform has failed to approve itself as a superior remedy. In gastric catarrh iodoform renders service in checking fermentations, but its powerful odor renders it objectionable to patients. Drs. Lardier and Pernet have obtained good results in dysentery from the administration of iodoform in daily doses of 0.25 to 0.38 Gm. (or gr. iv-vj), given in capsules with opium. Favorable reports have been made by Professors Moleschott and Bozzolo concerning the use of iodoform in diabetes. The remedy was given in daily doses of 0.50 Gm. (or gr. viij). Other observers have failed to confirm these results. In 0.065 Gm. (or gr. j) doses it has been used by Professor Sim and others in cases of tænia and ascarides.

Odorless Iodoform has recently been brought to the attention of the profession of the country by Messrs. Johnson & Johnson. It has the full equivalent of iodine and has the physical characters of iodoform without the objectionable odor. It is a cicatrizant and causes the rapid healing of wounds, acting in all respects like iodoform.

Di-iodoform.—This is another substance which has been brought forward for the purpose of obtaining the benefits of iodoform without the disadvantages pertaining to its offensive odor. Di-iodoform is a definite iodide of carbon, and is derived from ethylene or olefiant gas. It is a yellow substance, almost free from odor at ordinary temperatures, melting at 377.6° F., decomposing into its constituents under 392°. Di-iodoform contains 4.62 per cent. of carbon and 95.38 per cent. of iodine. It volatizes when heated, and can be sublimed. Di-iodoform is insoluble in water, and slightly soluble in alcohol, but it readily dissolves in carbon disulphide, chloroform, and benzin. It undergoes alteration when exposed to the light. It is said to be well borne by the stomach, and to be comparatively non-toxic. Di-iodoform has been used with success by M. Maquenne in the treatment of ulcerated chancroids and wounds.

IODOLUM (U. S. P.).—**Iodol** (C_4I_4NH), **Tetra-iodo-pyrol.** By the action of iodine upon the base pyrol a chemical compound is formed containing 88.97 per cent. of iodine,—therefore a little less than iodoform,—but having the important advantage of freedom from odor. Iodol occurs as a grayish-white powder, which darkens upon exposure to light; insoluble, or nearly so, in water; freely soluble in ether, chloroform, or alcohol, and in fatty oils. It is soluble in the gastric secretions, and, like iodoform, is decomposed in the organism. Iodol is rapidly absorbed, and iodine soon appears in the saliva and urine. It is said not to produce stomatitis or nasal catarrh. Professor Pick found that, when given in quantities as large as 2 to 3 Gm. (or gr. xxx-xlv) a day, it produced no further inconvenience than some headache and diarrhœa, which, however, soon disappeared. The effects of iodol are similar to those of iodoform, but it is said never to produce toxic action when used either as a topical application to wounds or when administered internally in the ordinary medicinal doses. This statement, however, must be regarded as too positive. Dr. Marcus saw iodol cause death in animals from fatty degeneration of various organs, and a case has been reported by Lauenstein in which the external application of iodol caused vertigo, vomiting, fever, and albuminuria.

Therapy.—Iodol may be dusted over wounds in the form of an impalpable powder, or it may be used in ointment or solution. An ointment of iodol may be made of any desired strength, from 0.65 Gm. (or gr. x) to 31 Gm. (or ℥j) upward, and constitutes an excellent antiseptic dressing to venereal and common ulcers, furuncles, and carbuncles. A weak ointment containing this substance is beneficial in variola, in which it mitigates the active cutaneous inflammation. A stronger preparation may be employed in tinea tonsurans, and is capable of modifying the course of psoriasis. Iodol ointment is used with advantage upon the enlarged glands of scrofula, or upon the ulcers consequent to their caseous degeneration. Schmidt considers iodol superior to iodoform in the treatment of fistulæ. An ethereal solution (1 to 8) is used as that of iodoform is: in ulcers of mucous membranes. Dr. Tarbau, of Davos, obtained good results in ozæna from the use of equal parts of iodol, tannic acid, and borax as a snuff. Cervicitis, endometritis, and metrorrhagia have been decidedly benefited by the local application of powdered iodol. The topical application of iodol has been found of service by Professor Pick in vaginitis, whether of simple or gonorrhœal origin.

Administered by insufflation or inhalation, this remedy has afforded relief in tuberculosis of the larynx or lung, and in bronchorrhœa. The powder has been found of service in various diseases of the eye, and is of special value in catarrhal conjunctivitis. It is useful, likewise, in otorrhœa associated with caries of bone. Iodol is also made into suppositories, soluble bougies, iodol cotton, iodol gauze, etc. It may be administered internally in any form—since it has very little taste and yields iodine to the organism very readily—in the treatment of the tertiary stage of syphilis, in scrofula, phthisis, etc. In these affections from 0.32 to 1.30 Gm. (or gr. v-xx) have been given daily, and in the dose of 0.13 to 0.38 Gm. (or gr. ii-vj) thrice daily Cerna has seen good results from the use of iodol in diabetes. Favorable results have been published by Pick, Cervesato, Martin, Lublinski, Seifert, Szadeck, and other observers. Cervesato, in three cases, saw absorption of pleural exudations promoted by the internal administration of iodol. Good reports have been made of the use in cerebro-spinal meningitis of a combination of 0.32 Gm. (or gr. v) of iodol and 0.17 Gm. (or gr. iiss) of acetanilide every third hour. Iodol is best given in wafers or capsules.

Caffeinated Iodol.—This is a crystalline product obtained by mixing alcoholic solutions of caffeine and iodol in molecular proportion. It contains 74.6 per cent. of iodol and 25.4 per cent. of caffeine. The compound is of a light-gray color, destitute of odor or taste, and is proposed as a substitute for iodol. Caffeinated iodol is a stable body, and is nearly or quite insoluble in most menstrua. This remedy is too expensive for general use.

IODUM (U. S. P., B. P.).—**Iodine.**

Dose, 0.03 to 0.065 Gm. (or gr. ss-j).

Preparations.

Ammonii Iodidum (U. S. P.).—Ammonium Iodide. Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Argenti Iodidum (U. S. P.).—Silver Iodide. Dose, 0.065 to 0.13 Gm. (or gr. i-ij).

Ferri Iodidum Saccharatum (U. S. P.).—Saccharated Ferrous Iodide. Dose, 0.13 to 0.65 Gm. (or gr. ii-x).

Hydrargyri Iodidum Flavum (U. S. P.).—Yellow Mercurous Iodide. Dose, 0.006 to 0.02 Gm. (or gr. $^1/_{10}$-$^1/_8$).

Liquor Iodi Compositus (U. S. P.).—Compound Solution of Iodine, Lugol's Solution (iodine, 5; potassium iodide, 10; distilled water, 85 parts). Dose, 0.30 to 1.20 c.cm. (or *m*v-xx).

Zinci Iodidum (U. S. P.).—Zinc Iodide. Dose, 0.065 to 0.20 Gm. (or gr. i-iij).

Syrupus Acidi Hydriodici (U. S. P.).—Syrup of Hydriodic Acid (1 per cent. of absolute acid). Dose, 2 to 15 c.cm. (or f3ss-f3ss).

Pilulæ Ferri Iodidi (U. S. P.).—Pills of Ferrous Iodide. Dose, 1 or 2 pills.

Tinctura Iodi (U. S. P., B. P.).—Tincture of Iodine (iodine, 7 per cent.; with potassium iodide, 5; B. P., about half this strength). Dose, 0.06 to 0.30 c.cm. (or *m*i-v). B. P., double this dose.

Unguentum Iodi (U. S. P., B. P.).—Iodine Ointment (U. S. P. contains iodine, 4; potassium iodide, 1; water, 2; benzoinated lard, 93 parts).

Liquor Arseni et Hydrargyri Iodidi (U. S. P., B. P.).—Solution of Arsenic and Mercuric Iodide (Donovan's solution, 1 per cent. each of arsenic iodide and mercuric iodide). Dose, 0.06 to 0.60 c.cm. (or *m*i-x).

Syrupus Ferri Iodidi (U. S. P., B. P.).—Syrup of Ferrous Iodide. Dose, 0.60 to 4 c.cm. (or *m*x-f3j).

Potassii Iodidum (U. S. P., B. P.).—Potassium Iodide. Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Unguentum Potassii Iodidi (U. S. P., B. P.).—Ointment of Potassium Iodide (U. S. P. contains potassium iodide, 12; sodium hyposulphite, 1; boiling water, 10; benzoinated lard, 77 parts).

Sodii Iodidum (U. S. P., B. P.).—Sodium Iodide. Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Arseni Iodidum (U. S. P., B. P.).—Arsenic Iodide. Dose, 0.003 Gm. (or gr. $^1/_{20}$).

Sulphuris Iodidum (U. S. P., B. P.).—Sulphur Iodide. Dose, 0.065 to 0.25 Gm. (or gr. i-iv).

Hydrargyri Iodidum Rubrum (U. S. P., B. P.).—Red Mercuric Iodide. Dose, 0.0016 to 0.006 Gm. (or gr. $^1/_{40}$-$^1/_{10}$).

Plumbi Iodidum (U. S. P., B. P.).—Lead Iodide. For external use.

Unguentum Sulphuris Iodidi (B. P.).—Sulphur-Iodide Ointment (2 Gm., or gr. xxx, to lard, 46 Gm., or ʒiss).

Liquor Iodi Fortis (B. P.).—Strong Solution of Iodine (iodine, 50 Gm.; potassium iodide, 30 Gm.; distilled water, 50 c.cm.; alcohol, 90 per cent., 360 c.cm.). Dose, 0.06 to 0.12 c.cm. (or *m*i-ij).

Pharmacology.—Iodine is a bluish-gray, non-metallic element, obtained principally from the ashes of sea-weeds. It was discovered in 1811 by Courtois, and its properties investigated by Gay Lussac in 1813. Iodine melts and sublimes at about 225° F., but volatilizes at ordinary temperatures, so that the upper part of the bottle containing it is usually filled with the characteristic violet vapor of iodine. It is very slightly soluble in water, requiring 7000 parts of water; on the contrary, alcohol and ether dissolve it freely, forming dark-brown solutions. The addition of water to the alcoholic solution precipitates part of the iodine, unless potassium iodide be added to the solution. The tincture of iodine may be decolorized by the addition of a small quantity of ammonia-water, followed by a few drops of carbolic acid, or by combination with sodium hyposulphite, making colorless tincture of iodine. The ammonia preparation should not be made in quantity or kept on hand, as it may deposit the iodide of nitrogen, which is a dangerous explosive compound. The combinations of iodine are numerous, and many of them are official. Ethyl-iodide is not included in the pharmacopœia, but has considerable medical interest. It is prepared by the action of alcohol on iodine in presence of amorphous phosphorus. Phosphorus iodide is formed and reacts upon the alcohol, yielding ethyl-iodide and an acid of phosphorus. The former distills into the receiver together with the alcohol, which escapes the reaction. Water is added and the lower layer of liquid is separated, dried with calcium chloride, and rectified in a water-bath. Ethyl-iodide is a colorless liquid, but becomes brown when long kept, if exposed to light. The syrup of hydriodic acid contains 1 per cent. of absolute hydriodic acid, which is a gaseous body containing 99 $^1/_4$ per cent. of iodine by weight; it is readily decomposed, and is a valuable agent for the purpose of introducing iodine into the system in the least irritating form, though therapeutically active. The iodide of starch, amylum iodatum (not to be confounded with amyl iodidum, iodide of amyl), was formerly official as a means of administering iodine, but it has been given in quantities as high as an ounce at a time with little noticeable effect, and is seldom used at present. This may be explained by the fact that starch is the antidote to iodine, and is the chemical test for free iodine, by which it is turned from a white color to blue. Iodine trichloride occurs in yellow pieces, and is decomposed by water into hydrochloric and iodic acids. It is liquefied by the addition of iodine. Iodine trichloride is a stable compound if preserved from contact with organic matter. Iodine tribromide has also been utilized to a certain extent as a local application. The following are some newer

compounds: *Atropine iodate* ($C_{17}H_{23}NO_3.HIO_3$) occurs as colorless needles soluble in water and in alcohol. Its solutions remain free from germs for quite a length of time, so that the addition of an antiseptic is unnecessary. *Codeine iodate* ($C_{18}H_{21}NO_3 + {}_2HIO_3$) occurs as white needles slightly soluble in water or alcohol; with age the salt decomposes, assuming a brown coloration from the liberation of iodine. *Lithium iodate* ($LiIO_3 + 1\text{-}2H_2O$) is a white powder freely soluble in water. *Mercuric iodate* ($Hg[IO_3]_2$) occurs as a white, amorphous powder, almost insoluble in plain water, but soluble in water containing sodium chloride or potassium iodide. *Quinine iodate* ($C_{20}H_{24}N_2O_2.HIO_3$) is a white, crystalline powder, soluble in water. *Scopolamine iodate* ($C_{17}H_{21}NO_4.HIO_3$) occurs as colorless crystals, soluble in water and in alcohol. *Strychnine iodate* ($C_{21}H_{22}N_2O_2.HIO_3$) comes in long, colorless needles, usually conglomerated and soluble in water.

As the iodides are easily decomposed, this fact must be borne in mind when prescribing them, and, as a rule, it is best to administer them simply dissolved in water or combined with other iodides. When potassium iodide is present in solution with corrosive sublimate the biniodide is formed, which is again dissolved in an excess of the potassium iodide. Alkalies, alkaloids, and metallic salts generally are incompatible with iodine and its salts.

The Iodine Test for Semen.—The difficulty of identifying spermatozoa by the microscope in the case of old stains is admitted. Florence, of Lyons, has introduced a chemical test which appears to be valuable,[1] judging by recent reports. The reagent is one used in testing alkaloids, known as the tri-iodide of potassium (KI_3). The formula is: iodide of potassium, 1.65 Gm. (or gr. xxv); iodine, 2.46 Gm. (or gr. xxxviij); and distilled water, 30 c.cm. (or f℥j). When a drop of the liquid obtained by moistening a seminal stain is placed side by side with a drop of this solution on a slide large numbers of peculiar brownish-red, pointed crystals appear. They are rhomboidal, and closely resemble hæmin crystals. Dr. Wyatt Johnson states[2] that he readily obtained the reaction with stains a year old. He also confirms Florence's statement that other secretions of the body—such as blood, urine, sweat, saliva, tears, bile, milk, pus, nasal or vaginal mucus—will not give the reaction. With the semen of animals in some cases he obtained a doubtful reaction. Dr. W. F. Whitney[3] also obtained the reaction readily. But as alkaloids give a precipitate with the reagent, its value, like the guaiacum test for blood, is chiefly negative. The last writer has found the following method of examining a seminal stain even as old as two and a half years successful. A drop of fluid obtained from the moistened stain is evaporated and fixed by a flame. The film is stained with eosin and methyl-green and mounted. At the base of the head of the spermatozoa is an hemispherical portion, which stains a deep green, while the anterior part and tail stain red. This serves at once to identify them, as there is no other oval spore or cell which has an eccentric hemispherical nucleus. He furthermore claims that the test proves them to be human, as in no other animal is there a deep staining. When this test is combined with Florence's there ought to be no difficulty in coming to a conclusion.

Physiological Action and Toxicology.—Iodine discolors the skin, turning it brown, and, if sufficiently concentrated, acts as an irritant, and may

[1] *Archives d'Anthropologie Criminelle*, Jan., Feb., and March, 1896.
[2] *Boston Medical and Surgical Journal*, April 8, 1897.
[3] *Boston Medical and Surgical Journal*, April 8, 1897.

cause vesication or sloughing. After a coat of iodine there is some hyperæmia, and the sensory nerves are stimulated so that the effects of a counter-irritant are obtained; subsequently, the superficial epithelial layer becomes dry and peels off, leaving a reddened surface. Its vapor is rather irritating to the air-passages. Iodine is a valuable antiseptic, and, when inhaled into the bronchial tubes, or separated from the general circulation and deposited upon the surface of the bronchial mucous membrane, it exercises a beneficial influence upon the tissues and prevents decomposition of the secretions. In the stomach it is at first irritant, but rapidly forms combinations with organic or starchy compounds and passes into the blood, where it acts as an alterant, and especially counteracts the effects of the syphilitic virus and promotes the absorption and removal of its products from the body. To a less marked degree this remedy acts upon the tissues affected by tuberculosis, removing effete material and rendering them less favorable for the development of bacilli. The alkaline iodides are very soluble (potassium iodide dissolving in its own weight of water), and diffuse readily into the blood. Stockman and Charteris found that sodium and potassium iodides, when given in the ordinary doses, to man, by the stomach, have no depressing effects on the action of the heart, or on the arterial tension.[1] They are excreted especially by the air-passages, and frequently set up a coryza and profuse mucus discharge from the bronchial mucous membrane.

The most common form of iodide eruption is that of papules, or wheals, which are darker than the adjoining skin and surrounded by a zone of inflammation (acneiform); but occasionally, from some peculiar susceptibility to the action of the drug, the degree of hyperæmia is so great as to lead to effusion beneath the epidermis, and vesicles are formed, filled with clear lymph, which afterward becomes white or milky. Sometimes the eruption is so universal that it resembles chicken-pox, purpura, or small-pox, but is unaccompanied by fever, or by more than a transient elevation of temperature. An acute eczema, accompanied by constitutional disorder, has been observed as a result of the ingestion of this drug. Dr. R. W. Taylor has described a remarkable case in which, after large doses of potassium iodide, a number of large tumors appeared upon the face.

Other symptoms—such as headache, unpleasant taste in the mouth, ptyalism, disordered digestion, malaise, and emaciation—appear after the system has become saturated with the drug, and these symptoms indicate the condition of **iodism**, which varies in degree from merely a few acneiform papules upon the forehead to a state of irritant poisoning. Œdema of the glottis is an occasional effect of the ingestion of potassium iodide. This manifestation, which takes place in the absence of any pathological condition of larynx or kidney, has been made the subject of a paper by Dr. Groenouw. This writer refers the origin of the accident to idiosyncrasy, and remarks that it does not follow the repeated administration of large doses of the salt, but manifests itself after a few comparatively small doses have been taken.[2] Other unusual manifestations of iodine poisoning are occasionally witnessed. Gautier has reported a case in which the symptoms were thought to be due to prolonged inhalation of sea-air, and another in which iodism was caused by inunction with potassium iodide. Each of these cases was marked by emaciation and prostration. In the second case fixed delusions and melancholic mania were present. Severe neuralgia, especially of

[1] *British Medical Journal*, June, 1901.

[2] *Revue de Laryngologie*, etc., Sept. 15, 1890; *Medical Bulletin*, Feb., 1891.

the trifacial, sometimes follows the administration even of small doses of potassium iodide. Pains in the extremities are also occasioned in some instances. Jonathan Hutchinson has frequently noted a sense of numbness, simulating sensory paralysis, but disappearing when the use of the iodide is discontinued. Affections of the nerves of special sense may be caused by this drug; hyperæsthesia of the retina, photophobia, fixed contraction and dilatation of the pupil have been seen as the result of the ingestion of iodine. Dr. Ernest Finger points out that, as iodine has been experimentally shown to produce dilatation of the cerebral blood-vessels, with retardation of the circulation, it should be cautiously given whenever intracranial lesions exist. He has known paralysis and retinal hæmorrhage to be excited by its use.

The phenomena of iodism are particularly apt to occur in persons who suffer from renal disease. Death on the sixth day, followed the free application of iodine to the legs of a negro boy.

In the absence of special idiosyncrasy, large doses are most productive of iodism in children and old people. Maniacal symptoms have supervened in consequence of massive doses.

Dr. W. L. Russel has reported a case of death from iodism. The administration of a few small doses of potassium iodide combined with syrup of ferrous iodide was followed by inflammation of the eyes, nose, and throat, together with a bullous eruption upon the skin. Death occurred on the tenth day after the first dose had been taken from a low grade of pneumonia and inanition. A case of fatal cachexia thyreopriva[1] from the administration of iodide of potassium has been reported. The goitre was a large one, and the attending physician ordered the application of a salve containing iodine, and the internal administration of iodide of potassium, 4 Gm. (or ʒj) *pro die.* The effect of the medicine was very striking, and in three weeks the tumor had grown much smaller; but from the beginning of the treatment, in addition to symptoms of iodism, other symptoms—such as vomiting, trembling, and tachycardia—were present. The iodine was given up, but these symptoms of cachexia thyreopriva continued, and the patient died in about one month after the beginning of the treatment, with marked circulatory and respiratory disturbances, similar to those seen in exophthalmic goitre. It appears that goitrous patients are liable to a form of iodine intoxication, which is called by Geneva physicians "Constitutional iodism," which may result from comparatively small doses. Trousseau denied that this was attributable to iodine directly, and claimed that it was a condition of latent Graves's disease, aggravated by iodine. Indeed, as pointed out by Jaunin,[2] the symptoms resemble closely the condition known as thyroidism, sometimes seen after administering preparations of thyroid gland. Whatever may be the explanation, it must be admitted that some persons show a marked intolerance to the iodides, while others may take very large quantities, not only with impunity, but with marked benefit.

Hare has called attention to a practical point, which is that, with the administration of small doses of carminatives, the iodine reaction appears more quickly in the saliva than when the potassium iodide is given alone. He, therefore, recommends the combination of 0.60 c.cm. (or *m*x) of tincture

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[1] *Correspondenz-blatt f. Schweizer Aerzte*, 1896, No. 3.

[2] *Revue Médicale de la Suisse Romande*, May 20, 1899.

of capsicum, with each dose, which also causes it to agree better with the stomach.

The treatment of iodism is largely symptomatic, using starch if there is free iodine in the alimentary canal, deodorized tincture of opium, warm baths, and large draughts of water and demulcents. Ehrlich has drawn attention to the probable value, on theoretical grounds, of sulphanilic acid in overcoming, or neutralizing, the effect of iodine. With regard to the dose, 6 c.cm. (or f℥iss) may be given during the day without inconvenience. It should be given in conjunction with sodium bicarbonate to facilitate the solution of the acid.

Chemical considerations have suggested the theory that the phenomena of iodism are due to the liberation of iodine by nitrites present in the blood. This change can only take place in regions where the reaction is acid. According to Röhmann and Malachowski, from 8 to 12 Gm. (or ℥ii-iij) of sodium bicarbonate, given in two doses within twenty-four hours, will cause the symptoms of chronic iodine poisoning to disappear. These writers likewise claim that, when potassium iodide and sodium bicarbonate are administered in combination, the symptoms of iodism are prevented. The carbonate or the aromatic spirit of ammonium has been given with the iodide for the same purpose, but with doubtful results. A few drops of Fowler's solution, given in conjunction with the iodide, is, however, more effective, and will usually prevent the development of iodism. The association of a small dose of belladonna or an equal quantity of the potassium bromide with iodide is also recommended as a preventive of toxic manifestations from iodine. It should not be forgotten that even a small dose of iodine will, in some persons, produce marked physical and mental depression without the occurrence of coryza, sore throat, or disturbed stomach. An acute form of intoxication may also arise from the administration of iodine, the symptoms being those of acute gastro-enteritis, the treatment consisting of starch-water, evacuation of the stomach, external heat, and hypodermic injections of cardiac and respiratory stimulants. In a case of chronic poisoning, with alarming prostration, Whitla availed himself of the fact that elimination takes place largely by the salivary glands, and directed his patient to chew pellitory-root: a powerful sialagogue. A hypodermic injection of pilocarpine would have a similar effect.

Death has occasionally been caused by iodine, whether taken into the stomach or injected into the cavities of the body. The fatal event may be delayed for a number of days and may then take place suddenly from heart-failure. The vomiting excited by iodic intoxication is of a yellowish-brown color, or blue if starchy matter had been present in the stomach. Dr. W. O. Culpeper has recorded a case in which the application of the tincture of iodine externally caused extensive sloughing, symptoms of acute iodism and death on the sixth day. The patient was a child of eleven years. In some of the cases where iodine was absorbed from the cavities of the body the egesta contained the drug. Iodine, after absorption, enters into all the tissues and fluids of the body. It is chiefly eliminated by the kidneys, partly in the form of an alkaline iodide and partly in organic combination. According to Professor Sée, it accumulates within the system when given continuously, and can be detected in the saliva after it has disappeared from the urine. Iodine is probably excreted to some extent by all the mucous membranes.

The iodides remove certain metallic poisons from the system by combining with them to produce soluble salts; in such cases large doses of iodides might liberate so much of the metal from the tissues as to produce symptoms of metallic poisoning. This is exemplified by the fact that potassium iodide may occasion salivation in an individual who has been upon a mercurial course. If a considerable quantity of the metal have been stored up within the system, its solution and entrance into the circulation may be followed by ptyalism. On the other hand, when there has been less accumulation of the mercury, potassium iodide will rapidly remove it from the system. The iodide thus exerts an apparently paradoxical action, in that it sometimes relieves and at others augments mercurial ptyalism. In recent cases of mercurialism, however, the iodide will but add to the mischief.

Patients should be warned, on the appearance of such symptoms or on the occurrence of iodism, to discontinue the remedy at once. Some are unable to bear more than a few grains, and even so small a quantity as 0.32 Gm. (or gr. v) may produce coryza, salivation, or a general vesicular eruption upon the skin; others can take as many drachms without the slightest inconvenience, and some dermatologists give from 46.5 to 62 Gm. (or ʒxii-xvj) of potassium iodide a day for tertiary syphilis without producing iodism. Part of the good effects of codliver-oil in these disorders is ascribed to a small proportion of iodine which it contains.

In the normal condition the iodides and iodine have no effect upon temperature or blood-pressure, when administered by the ordinary channels. Introduced into the veins, they cause slight increase, soon followed by decrease, of pressure. According to Germain Sée, potassium iodide reduces the size of the heart.

Anaphrodisiac effects are observed after the long-continued use of potassium iodide, and the belief is generally entertained, though disputed by some, that such protracted use causes atrophy of the mammary glands and testicles. A full or somewhat excessive dose of iodine has been known to cause sexual excitement, and Professor Stillé states that it may give rise to profuse menstruation or occasion abortion during pregnancy.

Owing to its solubility, potassium iodide is rapidly absorbed and rapidly eliminated. Within fifteen minutes after its ingestion it is present in the saliva and urine. It is likewise removed by the skin, and in the milk of nursing women. Iodine has been found in the urine of a suckling babe, whose mother was taking potassium iodide. The urine is increased in quantity by potassium iodide, though we lack exact knowledge of the effect of the drug upon the urinary constituents. It often causes oxalates to appear.

In some instances its administration has been followed by albuminuria.

In a series of experiments upon himself, M. Georges Doux took 3 Gm. (or gr. xlv) of potassium iodide twice daily for twenty consecutive days. After the second day the quantity of the salt present in the urine varied but little, and amounted to about 90 per cent. of the dose ingested. The normal proportion of urea was decreased by about one-fifth. Seventy-five hours after discontinuance of the drug no trace of it could be discovered in the urine. The experiments were twice repeated with the same results. The amount of iodide eliminated fell to 60 per cent. if a little absinthe had been taken on the preceding day.[1]

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[1] *British Medical Journal*, Sept. 27, 1890.

The effect of small doses of potassium iodide upon nutrition has been studied by Volkoff and Stadnitzki, of St. Petersburg. These writers report that the assimilation of carbohydrates in the food is but slightly diminished, the nitrogenous exchange is increased, oxidation is diminished and the destruction of organic albumin is increased, judging by the augmented quantity of sulphur in the urine. The weight of the body is but slightly decreased and the assimilation of fat is diminished to a very slight extent. Dr. Haig believes that the iodides diminish the excretion of uric acid and the urates.

Antidotes.—The treatment of a case in which iodine has been taken into the stomach, should begin with the administration of starch in warm water; or flour and water. Sodium bicarbonate may also be given. The starch-iodine compound should not be allowed to remain in the stomach, but be removed by stomach tube, or by vomiting. Small doses of pilocarpine may assist elimination. The subsequent treatment is that of gastritis, mainly.

Therapy.—Iodine in substance may be used as a disinfectant for drains, but it has no advantage over much less expensive agents which are better antiseptics. In the form of tincture it is very generally used as a counter-irritant and resolvent for various swellings, enlarged glands, buboes, swollen joints, abscesses, chilblains, and inflammation of the gums.

The antiseptic action of iodine is utilized in surgery, by Nicholas Senn,[1] of Chicago, in preparing patients for operation. Douches containing iodine have been used in obstetrics, to overcome septic infection. The parasiticide effects are shown when this tincture is painted over a spot of tinea or ringworm, which may yield to this treatment. In chronic ring-worm, Dr. C. W. Cutler, of New York, uses with good results the following mixture:—

℞ Phenolis liq.,
Chloralis hydratis ..... aa 31| Gm. or ℥j.
Tr. iodi ..... 30| c.cm. or f℥j.—M.

The local application of tincture of iodine is efficacious in tinea versicolor when the patches are not too large or numerous.

For toothache from exposed pulp, Garretson recommended the following:—

℞ Creosoti ..... |37 c.cm. or *m*vj.
Tinct. iodi,
Liq. plumbi subacetatis ..... aa 4| c.cm. or f3j.
Chloroformi,
Tinct. opii ..... aa 2| c.cm. or f3ss.

M. Sig.: Apply on absorbent cotton to the pulp. Brush the same on the surrounding gum.

The local application of the tincture of iodine has been recommended in order to arrest retraction of the gums in aged people.

The dental ointment of potassium iodide, recommended by Flagg, consists of the following:—

℞ Potassii iodidi ..... 1|30 Gm. or gr. xx.
Liquoris potassæ ..... |12 vel |18 c.cm. or *m*ij vel iij.
Cerati simplicis ..... 31| Gm. or ℥j.
M. et ft. ungt.

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[1] *Columbus Medical Journal*, August, 1905.

This is a valuable ointment, which will not discolor the skin, used in producing absorption of indurations on or about the face and jaws.

A colorless iodine ointment may be prepared according to the following formula:—

℞ Iodi	1	30 Gm. or gr. xx.
Potass. iodidi		25 Gm. or gr. iv.
Sodii sulphitis	2	60 Gm. or gr. xl.
Aquæ	q. s.	

Rub the ingredients with the water till the solution is colorless. Then add:—

Adipis benzoinat.	31	Gm. or ℥j.—M.

Dr. Dunin has given potassium iodide in about 100 cases of biliary colic with considerable success. It acts most favorably in cases characterized less by pain than by frequency of attacks and especially in those exhausted by loss of sleep, anorexia, or prolonged use of narcotics. He prescribes 0.32 to 0.65 Gm. (or gr. v-x) twice daily for four or five weeks and this is followed by a course of Carlsbad water.

In pneumonia and pleurisy, especially of the chronic form, or fibroid phthisis, great benefit results from painting the affected side of the chest with iodine, giving several coats of the tincture with a camel's-hair brush, repeated each day until sufficient action is set up or the skin peels off. Part of the iodine is absorbed and exercises a local alterative effect.

In chronic bronchitis, also, the tincture of iodine is serviceably applied to the chest. The ointment, tincture, or liniment of iodine affords relief in intercostal neuralgia and rheumatism affecting the intercostal muscles. The conjoined internal and external use of iodine is of great value in bronchocele. In simple glandular hypertrophy, the compound solution of iodine or potassium iodide, preferably the latter, is administered by the mouth; while the tincture, liniment, or ointment is locally applied, care being taken to avoid vesication. The ointment of potassium iodide is sometimes employed for the same purpose or the B. P. official ointment of the red mercuric iodide. The remarkably successful method practiced by the East-Indian army-surgeons consisted in the application of the ointment of the red iodide, after which the patient was made to sit for some hours with his neck exposed to the rays of the sun or to a hot fire. Assuming that the action of the remedy was increased by the influence of heat, Dr. Dawson Turner, of Edinburgh, suggests that the fact may be explained by the physical properties of iodine. A solution of iodine in carbon disulphide cuts off the visible rays of the sun, but transmits the invisible heat-rays. From this circumstance the deduction is drawn that diseased parts to which iodine has been applied should not be covered, but subjected to the action of the heat.

Another excellent method consists in the injection of tincture of iodine into the substance of the goitre. It is best to begin with no more than 0.30 c.cm. (or *m*v), the operation being repeated weekly or semiweekly and the quantity gradually increased to 0.60, 1, or 1.20 c.cm. (or *m*x, xv, or xx). In cystic or calcareous degeneration of the thyroid this plan of treatment is of no avail. Other hypertrophies are amenable to the same method, as, for instance, enlarged lymphatic glands prior to caseation and enlarged spleen. The cavities of abscesses and monocystic tumors are, after evacuation, advantageously flushed with water impregnated with a small quantity of tincture of iodine. Empyema has been treated in the same way after aspiration.

Since proposed, in 1848, by Dr. Brainard, the injection of iodine has been practiced with varying and doubtful success in spina bifida. Cures have been reported, while, on the other hand, many failures, whether reported or not, have occurred. If this operation be undertaken the quantity injected should be small and the solution weak. No more serum should be withdrawn than the quantity of fluid about to be injected. Pepper and others have injected the tincture of iodine into pulmonary cavities with a view to disinfection, and, possibly, obliteration by healthy reparative inflammation. Though the plan seems rational, it is not always feasible, is attended by some pain and reaction, and certainly has never been generally approved or adopted. The injection of iodine, as in the Shurley-Gibbes plan of treating tuberculosis, usually gives rise to considerable pain. In order to overcome this disadvantage Dr. A. O. Squier incorporates with the original mixture a small quantity of creosote or guaiacol and some iodoform. His formula is:—

℞ Eucalyptol.	2	12 c.cm. or *m*xxxij.
Guaiacol. pur.	1	c.cm. or *m*xvj.
Iodoform.		50 Gm. or gr. viij.
Iodi		25 Gm. or gr. iv.
Ol. amygdal. dulc.	q. s. ad 30	c.cm. or f℥j.

M. Sig.: From 0.60 to 2 c.cm. (or *m*x-xxx) to be injected daily or alternating with gold-and-sodium solution as desired.

A solution of iodine has been employed by Professor Durante, of Rome, injected subcutaneously or into the substance of a muscle in cases of pulmonary and articular tuberculous disease. Dr. Mennella has made use of the same method in non-tuberculous affections of joints. Periarticular injections of iodine caused rapid disappearance of the fluid in two cases of hydrarthrosis of the knee of traumatic origin. A similar procedure was efficacious in glandular enlargements, syphilis, grave malarial cachexia, and other maladies.

The parenchymatous injection of a few minims of tincture of iodine causes resolution of enlarged tonsils. In performing this operation the close proximity of the carotid artery should be borne in mind. The ointment, applied directly to the tonsils by means of a camel's-hair brush, is said by Cerchiari to accomplish the same result. The application of the tincture diluted with seven or eight times its bulk of water will also generally produce the same effect.

The following prescription can sometimes be used with good effect in enlarged tonsils or in chronic pharyngitis:—

℞ Tinct. iodi	4	c.cm. or f℥j.
Glycerini, Fluidextracti ergotæ aa	30	c.cm. or f℥j.

M. Sig.: Apply once or twice a day with a camel's-hair brush.

Garretson employed in sore throat, especially that which occurs in clergymen and public speakers, the following combination of iodine:—

℞ Liq. iodi compositi	5	c.cm. or f℥i*m*xx.
Phenolis liquefact.	75	c.cm. or *m*xij.
Glycerini	60	c.cm. or f℥ij.
Aquæ	420	c.cm. or f℥xiv.

M. Sig.: To be used as a gargle from eight to a dozen times a day.

The tincture of iodine is often painted upon or around patches of erysipelas, and, although the application sometimes does good, it not infrequently aggravates the condition. It is judicious to dilute the preparation with an equal quantity of glycerin or alcohol, or combine the iodine as follows:—

℞ Tinct. iodi	2	c.cm. or f3ss.
Phenolis liquefact.	2	Gm. or 3ss.
Glycerini	120	c.cm. or f℥iv.

M. Sig.: Apply with a camel's-hair brush several times a day for erysipelas.

In ringworm iodine may be used in the form of colorless tincture, or in combination with the colorless oil of tar (1 in 4):—

℞ Potassii iodidi	8	Gm. or 3ij.
Ol. menth. pip.	1	20 c.cm. or *m*xx.
Adipis lanæ hyd.	31	Gm. or ℥j.

M. Sig.: Embrocation for painful joints, neuralgia, chronic rheumatism, etc.

Ringworm may also be efficaciously treated by means of iodized collodion, 0.50 to 0.75 Gm. (or gr. viii-xij) of metallic iodine being dissolved in alcohol and ether and added to 30 c.cm. (or f℥j) of collodion. The mixture is painted upon the affected part for several successive days until a thick layer is formed. This layer is left undisturbed for a fortnight.

The tincture of iodine is one of the articles employed to prevent pitting in small-pox. The solution should be painted over the surface of each pustule. An ointment containing iodine is occasionally followed by good results in keloid and scleroderma. Alone or combined with an equal quantity of glycerin or carbolic acid, the tincture of iodine is sometimes beneficial when painted upon lupous areas. Lentigo and chloasma may be cured by the local application of tincture of iodine, and the same preparation added to salt water forms a beneficial wash in chronic ozæna. In orchitis, after active inflammation has subsided, the cautious local application of the tincture promotes absorption of the exudation material. The same treatment is of service after subsidence of inflammation of the mammary gland or ovary.

Boils and carbuncles may be checked by painting iodine freely upon a neighboring vascular area. Iodine may be used as a stimulant to old ulcers, especially in gynæcology, as iodized phenol, although iodoform, on account of its anæsthetic effects, has largely taken the place of iodine. A saturated solution of tannic acid in tincture of iodine is also a useful topical application in chronic inflammation of the uterine canal. Dr. Routh states that the vomiting of pregnancy is arrested by brushing the cervix and lower part of the cervical canal with a mixture of equal parts of iodine, potassium iodide, alcohol, and water. Professor Tarnier made use of a mixture of tincture of iodine (30 c.cm., or f℥j) and potassium iodide (6 Gm., or 3iss) in distilled water, 1 quart, as an intra-uterine douche after labor. Dr. Chibret has proposed the application of tincture of iodine in certain forms of corneal ulceration, touching the affected surface once or twice daily with a small roll of cotton-wool moistened with the liquid. M. Sedan, who has made a trial of the local use of the tincture in the case of rebellious ulcers of the cornea, declares that the treatment is painful and unmanageable, and has a tendency to produce ciliary blepharitis.

Russian physicians have employed iodine with marked advantage in

hæmorrhoids. Ivanoff describes a severe case, rebellious to ordinary methods, in which the daily application of the tincture for three days caused almost complete disappearance of the large tumors. Preissman extols, in the same condition, the application of a compress moistened in a glycerin solution of iodine and potassium iodide. The iodide of starch is valued by Mr. Marshall as a dressing to syphilitic ulcers. Hydrocele is cured by evacuation of the contents of the sac and injecting 1 to 1.20 c.cm. (or *m*xv-xx) of tincture of iodine into the cavity. Severe inflammation results and the sac becomes obliterated. Iodized wool is useful for making extemporized pessaries. I. Rosenberg has found a 20-per-cent. solution of potassium iodide, painted upon the tongue, efficacious in the treatment of leucoplakia.

Internally, tincture of iodine and camphor may be inhaled for acute coryza and hay asthma.[1] Inhalation of the vapor of iodine is very beneficial in chronic bronchitis with bronchiectasis, or profuse and fetid muco-purulent expectoration.

The inhalation of iodine and turpentine is recommended in laryngeal and pulmonary tuberculosis by Dr. Jolly and others, who claim that it is an excellent adjuvant to the other methods by which it is sought to relieve the disease. This formula may be quoted:—

℞ Pulv. iodi	10 parts.
Alcohol.	20 parts.
Mix in a flask and add:—	
Ol. terebinthin. rectificat.	20 parts.
Spt. lavandulæ	10 parts.—M.

When the mixture is shaken the free iodine is lost and exists in the form of a terebinthinate compound. It has no irritant effect upon the mucous membranes.

Bartholow spoke favorably of the internal use of ammonium iodide in acute catarrh, 0.065 Gm. (or gr. j) being given every second hour. Hay asthma is ameliorated by larger doses of the same remedy, which is useful, moreover, in capillary bronchitis and bronchorrhœa. An acute coryza may not infrequently be aborted by 0.65 Gm. (or gr. x) of potassium iodide taken at bed-time. Ammonium iodide is also recommended for the same purpose. Potassium iodide in the same dose repeated several times a day is said to relieve paroxysmal sneezing.

In phthisis, good results have been reported from inhalation, by means of an atomizer, of fine spray containing 1 part each of potassium iodide and corrosive chloride of mercury in 1000 parts of water, the solution being made stronger or weaker, according to the effects upon the patient. From its stimulating effects upon the kidneys potassium iodide is occasionally used to heighten the effect of other diuretics. The œdema of Bright's disease is, in some instances, markedly decreased by this remedy, though it has little power to check the escape of albumin. Potassium iodide, from its special determination to the mucous membrane of the air-passages, is frequently combined with expectorants and cough-mixtures in order to render the secretions more fluid. Its stimulating action upon the absorbents renders iodine useful, both internally and by topical application, in cases of inflammatory exudation or chronic enlargements. Where these are of syphilitic

[1] *Therapeutic Gazette*, Oct. 15, 1890, p. 678.

character the iodides are pre-eminently serviceable. For many brain diseases, more especially those occurring during tertiary syphilis, where gummata form or meningitis with exudation occurs, causing great pain, potassium iodide in combination with bromide, is more efficient than any other agent known; here the iodide must be given in 2 to 4 Gm. (or 3ss-j) doses, and pushed in order to get its full effect. If given well diluted with water, when the stomach is empty, no serious danger exists of producing iodism. In aortic aneurism, potassium iodide, in doses of 1.30 to 2 Gm. (or gr. xx-xxx) four times a day, with low diet and rest in bed, favors deposit of fibrin and obliteration of the tumor; the treatment must extend over many months or for a year or more. Many of these cases may be occasioned by syphilitic disease of the aorta, and under these circumstances the iodide is doubly serviceable. In the primary and secondary forms of syphilis iodine compounds are of little use, but in the later changes of the skin, mucous membranes, and deeper structures they act promptly, and we may prescribe them with confidence.

In some of the late varieties of syphilis[1] the author can recommend the following formulæ containing the iodides:—

℞ Potassii iodidi	19	4	Gm. or 3v.
Tinct. cimicifugæ	7	5	c.cm. or f3ij.
Syr. sarsaparillæ comp.	150		c.cm. or f3v.

M. Sig.: Two teaspoonfuls in water three or four times a day.

℞ Sodii iodidi	10		Gm. or 3iiss.
Vini cocæ	300		c.cm. or f3x.

M. Sig.: A tablespoonful three or four times a day.

℞ Ammonii iodidi	19	4	Gm. or 3v.
Tinct. nucis vomicæ	4		c.cm. or f3j.
Fluidext. rhamnus pursh.	30		c.cm. or f3j.
Glycerini	120		c.cm. or f3iv.

M. Sig.: Two teaspoonfuls in water three or four times a day.

According to the investigations of Leone Levi, potassium iodide, administered to syphilitic subjects, improves the quality of the blood, increases weight and strength, but decreases the quantity of urea excreted. Pellizzari concludes that this salt has a chemical action upon the products of tertiary syphilis and neutralizes the toxic material as it is formed.

An efficient combination for use in tertiary syphilis is:—

℞ Hydrarg. iodid. rubri		20	Gm. or gr. iij.
Potassii iodid.	31		Gm. or 3j.
Tr. iodi	4		c.cm. or f3j.
Syr. ferri iodid.	30		c.cm. or f3j.
Aquæ	90		c.cm. or f3iij.

M. Sig.: A teaspoonful in water after each meal.

A combination of iodides is sometimes more efficient in late syphilis.

In the treatment of gonorrhœal rheumatism, Schüller, of Berlin, gives potassium iodide (0.32 to 0.45 Gm., or gr. v-vij) every two hours for two or three days. He considers it especially beneficial in the acute form. For local treatment he uses, in acute cases, compresses wet with carbolic-acid solution (1 to 100), and in chronic cases mercurial ointment. Aspiration of the joint

[1] For the general medicinal treatment of late syphilis see author's "Practical Treatise on Diseases of the Skin." D. Appleton & Co., New York, 1901.

is done where there is abundant effusion, and this procedure aids the action of the remedy. In chronic gout and in gouty affections, potassium iodide affords great relief, as it will also in chronic rheumatism. Considerable improvement sometimes follows the use of potassium or ferrous iodide in rheumatoid arthritis. Acute rheumatism is often relieved by large doses of potassium iodide, or the latter in combination with sodium salicylate or salicin:—

℞ Potassii iodidi,
Sodii salicylatis ..... aa 14| Gm. or 3iiiss.
Spiritus ætheris nitrosi ..... 60| c.cm. or f℥ij.
Syrupi aurantii ..... 90| c.cm. or f℥iij.
M. Sig.: Two teaspoonfuls in water every two or three hours.

℞ Potassii iodidi,
Salicin. ..... aa 6|50 Gm. or gr. c.
M. et ft. capsulæ no. xx.
Sig.: Two or three capsules every two or three hours.

In acute rheumatism or gout, when attended with constipation, the following prescription, containing potassium iodide, is serviceable:—

℞ Potassii iodidi,
Potassii acetatis ..... aa 14| Gm. or 3iiiss.
Fluidext. rhamnus pursh. .....
Glycerini ..... aa 30| c.cm. or f℥j.
Aquæ cinnamomi ..... 90| c.cm. or f℥iij.
M. Sig.: Two teaspoonfuls in water every two or three hours.

Potassium iodide is the most efficacious remedy in the treatment of actinomycosis. In a case reported by Buzzi and Valeirio the fistulæ began to close, the swelling and pain to disappear in a few days, and recovery was complete in three months. In the treatment of psoriasis[1] large doses of one of the iodides, and preferably potassium iodide, is at times attended with complete removal of the eruption. Psoriasis is, however, more frequently controlled or cured by potassium iodide when the disease depends upon rheumatism or gout. In periostitis, resulting from exposure to cold or wet, the iodides are rapidly curative, and the tincture may also be applied locally. In chronic mercury or lead poisoning the metal may be removed from the system by iodides, but the dose should be small and the treatment continued for some time. Chronic bronchitis with thick, tenacious sputa, and asthma are very much helped by the administration of the iodides. Catarrhal pneumonia, acute or chronic, is benefited by doses large enough to liquefy the sputa:—

℞ Potassii iodidi ..... 14| Gm. or 3iiiss.
Tinct. lobeliæ ..... 15| c.cm. or f3iv.
Spiritus ætheris comp. ..... 60| c.cm. or f℥ij.
Syrup. aurantii ..... 75| c.cm. or f℥iiss.
M. Sig.: From one to two teaspoonfuls in water every two or three hours until relieved. Serviceable in chronic bronchitis and in asthma.

In the broncho-pneumonia of measles, Dr. Bicente relies upon potassium iodide, which seldom fails to produce amendment within a few days, provided tuberculosis be not present. Dr. Valten asserts that the adminis-

[1] See paper by the author on "The Cause and Treatment of Psoriasis," "Transactions of the Pennsylvania State Medical Society," 1888.

tration of a large dose of potassium iodide—not less than 6 Gm. (or gr. xc), given singly or in divided portions within twelve or, at most, twenty-four hours after the initial chill—will bring about a rapid lysis or crisis of the fever in croupous pneumonia. This method does not abridge the course of the disease, but, it is claimed, obviates the danger of cardiac collapse. After the first twenty-four hours no benefit is derived from the use of the remedy. The writer furthermore states that excellent results are obtained in epidemic cerebro-spinal meningitis from the administration of potassium iodide in doses of 3 to 6 Gm. (or gr. xlv-xc), given once or several times during the day. Moody gives an account of several cases of the fulminant type and also of a local epidemic in which the iodine treatment recommended by Tanner was strikingly successful. His conclusions were as follow: In the fulminant or apoplectic form of cerebro-spinal meningitis no known treatment offers any hope of cure. In the ordinary form, commonly known as "spotted fever," potassium iodide is the only drug which has shown any power to modify the disease. That drug should not be depended on alone, but any means known to therapeutics should be employed whenever it renders the patient more comfortable or aids him to resist the exhausting conditions of the disease. Finally, the writer does not consider the known influence of the iodide on absorption a sufficient explanation of its usefulness in the disease, but thinks it more likely that it either has some quality that acts as an antidote to the toxins secreted by the pathogenic organisms or is unfavorable to their development.

In cardiac dropsy sodium iodide alone or combined with digitalis and buchu is often most beneficial in its effect. It can be prescribed thus:—

℞ Sodii iodidi ..... 15|5 Gm. or ʒiv.
Infus. digitalis,
Infus. buchu ..... aa 90| c.cm. or fʒiij.
M. Sig.: Two teaspoonfuls every three or four hours.

In Bright's disease Semmola prescribes:—

℞ Potass. iodid. ..... 1| Gm. or gr. xv.
Sodii phosphatis ..... 2| Gm. or gr. xxx.
Sodii chloridi ..... 6| Gm. or ʒiss.
Aquæ .....600| c.cm. or ℥xxfʒiij.
M. et ft. sol.
Sig.: The entire quantity in divided doses to be taken during the day.

Potassium iodide is likewise of value in pulmonary emphysema and in asthma, especially in that form associated with chronic bronchitis and emphysema. In asthma dependent upon gastric conditions it is of little or no avail.

In chronic bronchitis and pleurisy the following combinations are useful:—

℞ Potassii iodidi ..... 15|5 Gm. or ʒiv.
Syr. ferri iodidi,
Glycerini ..... aa 45| c.cm. or fʒiss.
M. Sig.: A teaspoonful in water four times a day.

℞ Potassii iodidi ..... 1|55 Gm. or gr. xxiv.
Potassii bromidi ..... 4| Gm. or ʒj.
Ammonii chloridi ..... 8| Gm. or ʒij.
Syr. eriodictyi aromat. (N. F.)
Aquæ ..... aa 45| c.cm. or fʒiss.
M. Sig.: A dessertspoonful every two or four hours, for cough with scanty expectoration.

Potassium iodide may be combined with potassium bromide for the treatment of epilepsy, as employed by Brown-Séquard.

Dr. Lauder Brunton states that potassium iodide is the most efficient remedy in preventing the recurrence of attacks of angina pectoris. For this purpose he prescribes it in doses of 0.32 to 2 Gm. (or gr. v-xxx) three times a day. Dr. Schweighofer has reported[1] a case of cretinism, associated with myxœdema and goitre, in which decided amendment followed the use of a like quantity of the same remedy, continued for nine months. The myxœdema and goitre were favorably influenced and the patient gained in intelligence.

Dr. Schleich, from his observation of ninety-two cases of deep wounds, believes that the administration of potassium iodide, in doses of 0.32 Gm. (or gr. v) three times a day, promotes repair.

The tincture of iodine has been administered internally in 0.30- to 0.50-c.cm. (or *m*v-viij) doses in the treatment of malarial affections; and the compound solution (Lugol's solution) is widely known as a remedy in scrofulous affections of the skin and of the lymphatic glands, especially in syphilitic children. The solution, with arsenic, is very serviceable in some old syphilitic skin diseases attended by thickening and scaling.

Rothe advises the use in whooping-cough of a combination of iodine and carbolic acid.

Dr. Renzi has observed a favorable influence upon the progress of pulmonary tuberculosis produced by the administration of a mixture containing iodine, potassium iodide, and sodium chloride.

Zinc iodide is in white, needle-shaped crystals, and is unstable. It is best administered as a syrup (4 Gm. in 30 c.cm., or 3i-f℥j); dose, 1.20 to 2.50 c.cm. (or *m*xx-xl). It has been used in ointment, with lard (10 per cent.), in the treatment of tumors, and a solution (0.065 to 0.13 Gm. to 30 c.cm., or gr. i-ij to f℥j) has been injected in gonorrhœa. Stronger solutions have been applied to enlarged tonsils.

Small and repeated doses of ammonium iodide are efficacious in catarrhal jaundice. This salt may be serviceably employed in bronchitis and broncho-pneumonia. It is also considered of advantage in the early stage of cirrhosis of the liver and in chronic malaria, associated in the latter condition with arsenic.

Drop doses of the tincture of iodine will sometimes allay the vomiting of pregnancy. In the form of tincture, compound solution, or potassium iodide, this agent has been employed in typhoid fever, and, though no marked influence is exerted upon the course of the disease, the temperature, or the diarrhœa, Liebermeister believes that it effects a notable reduction of the mortality. Bartholow's combination of the tincture of iodine and carbolic acid seems to moderate the severity of typhoid fever:—

℞ Tinct. iodi ..... 7|5 c.cm. or f3ij.
Phenolis liq. ..... 4| c.cm. or f3j.
M. Sig.: One to three drops thrice daily.

Chantemesse uses in furunculosis during typhoid fever, a solution of iodine (2 parts) in acetone (5 parts), applied with absorbent cotton. This iodo-acetone is stronger than tincture of iodine, and is more irritant when freshly made. One application is usually sufficient to abort a boil. If used

[1] *Lancet*, Dec. 16, 1893.

freely, it may excite an eruption, and even cause ulceration; applied to a granulating surface it causes pain.

Dr. Phillips has given with success the tincture of iodine in doses of a few minims in cases of atonic diarrhœa. This writer states, moreover, that the preparation, used in the same manner, will often cure the tormina and tenesmus of dysenteric diarrhœa.

Ringer states that "in some epidemics of diphtheria" the inhalation of the vapor of iodine proves of signal service, and Dr. S. N. Zènenko[1] has spoken very highly of the internal administration of potassium iodide in this affection. From 0.03 to 0.20 Gm. (or gr. ss-iij) was given to children, 0.32 to 0.50 Gm. (or gr. v-viij) to adults, and repeated every second, third, or fourth hour. Antiseptic gargles, alcoholic stimulation, and inunction of the enlarged cervical glands with mercurial ointment were used in conjunction. Of a series of twenty-one patients so treated, none died, while of nineteen cases treated during the same time, in the same hospital (at Nijni Novgorod), after ordinary plans, 84 per cent. ended in death. The internal administration of potassium iodide will sometimes reduce enlargement of the mammary gland or testicle, and by some physicians is said to check the secretion of milk. Sciatica and lumbago are sometimes relieved by the same remedy. It is useful in the first stage of hepatic cirrhosis, in hypertrophic metritis, and in various syphilitic manifestations, especially when other remedies are not well borne by the stomach. Uterine fibromyomata have been materially decreased in size by the use of this remedy either given by the mouth or injected into the substance of the growth. Chronic urticaria has been successfully treated with potassium iodide. Stern reported[2] five cases treated in this way. None were syphilitic, and all were rapidly cured. The itching was promptly relieved, and one patient became well after only 10 Gm. (or ʒiiss) had been administered, although he had suffered previously for four months.

Baczkiewicz states that potassium iodide is readily absorbed by the rectal mucous membrane, iodine being detected in the saliva in five to fifteen minutes after administration by enema or suppository. According to the numerous experiments of Calantoni on men and animals, potassium iodide is absorbed as rapidly by the bowel as by the stomach; if speedy absorption is particularly desirable it may be obtained by heating the solution to 98° F. Elimination after injection into the rectum is as rapid as when it is taken by the mouth.

Kobner administers a potassium-iodide combination by means of enema. Given once a day at first, but subsequently twice daily, the therapeutic action is said to be very rapid. He combines mercurial inunctions, and believes that this method is equally efficacious and better tolerated than subcutaneous injections. His formula is as follows:—

℞ Potassii iodidi	3	Gm.	or gr. xlv.
Potassii bromidi	1	Gm.	or gr. xv.
Extract. belladonnæ folior.	32	Gm.	or gr. v.
Aquæ	210	c.cm.	or fʒvij.—M.

Twenty-four c.cm. (or fʒviss) of this solution are added to 60 or 90 c.cm. (or fʒii-iij) of water and thrown into the rectum. Kobner frequently adds from 0.30 to 0.60 c.cm. (or *m*v-x) of pure tincture of iodine to each enema,

[1] *Vratch*, No. 42, 1890; *Satellite*, Jan., 1891.
[2] *London Medical Recorder*, Nov. 20, 1890.

and finds the mixture well tolerated by the large intestine. He has never observed any resulting local inflammation.

The potassium iodide and chlorate are incompatible, a deleterious salt, potassium iodate, being formed.

Iodized starch has lately been employed with asserted benefit by a number of Russian physicians as an intestinal disinfectant in typhoid fever and various septic affections of the bowels. It was given in the dose of 0.50 to 0.65 Gm. (or gr. viii-x). **Iodine trichloride**, obtained by passing chlorine-gas over iodine, occurs in the form of reddish crystals, is soluble in its own weight of water and freely soluble in alcohol. Either its aqueous or alcoholic solution can be mixed with glycerin without decomposition. Iodine trichloride has been employed by Belfield, of Chicago, in genito-urinary and surgical affections. He finds it of advantage in tuberculosis and suppuration. For instillation in the posterior urethra, for irrigation of the bladder, and for hypodermic injections, he made use of a $^1/_{10}$- to $^1/_2$-per-cent. solution, either in distilled water or in 4 parts of water with 1 part of glycerin. Serous cavities were injected with the same solutions. For cleansing suppurating wounds 1- to 5-per-cent. solutions were employed. To ulcerated carcinoma and venereal sores he applied a 5- to 20-per-cent. solution in equal parts of water, glycerin, and alcohol. Dr. Pflueger, of Berne, recommends iodine trichloride in various affections of the eye. For subconjunctival injections a 1 to 1500 solution was employed. As a collyrium, solutions from 0.1 to 1 per cent. were used. Gottschalk treated three cases of puerperal septicæmia, of which two recovered, by means of hypodermic injections of a 1-per-cent. solution, from 1 to 2 c.cm. (or *m*xv-xxx) being injected once or twice each day.

Iodine tribromide has been used by Kraus for gargles and inhalations in diphtheria. His solution contained 1.30 Gm. to 531 c.cm. (or gr. xx-f℥xviij) of water.

Ethyl-iodide is administered by inhalation (0.60 to 2 c.cm., or *m*x-xxx) whenever necessary to relieve coughing, especially in bronchitis, asthma, and phthisis, and is the most direct method of introducing iodine into the blood.

Iodantifebrin.—This substance results from the interaction of iodine chloride and acetanilid. It crystallizes in rhombic tablets, which are slightly soluble in cold water, alcohol, and ether; more freely soluble in hot alcohol and glacial acetic acid; is without odor or taste, and appears to pass through the organism unchanged. Dose, 0.13 to 0.50 Gm. (or gr. ii-viij).

Iodantipyrin.—This combination is prepared by a similar process to that which produces iodantifebrin. Iodantipyrin crystallizes in colorless, lustrous, and prismatic needles, is without taste or special odor, is scarcely soluble in cold water or alcohol, but dissolves when these menstrua are warmed. Dose, 0.03 to 0.13 Gm. (or gr. ss-ij).

Clinical experiments with both these bodies were carried on in the clinic of Professor von Jaksch, and the results have been published by Dr. Munzer. The antipyretic effects of iodantipyrin are identical with those of antipyrin, and, in all probability, it is decomposed in the stomach into antipyrin and iodine. The reduction of temperature was accompanied by sweating, but was unattended by collapse or chills.

Iodiphenin.—Iodiphenin, an iodine derivative of phenacetin, is a chocolate-brown powder, which, upon recrystallization from glacial acetic

acid, yields crystals of a steel-blue color. It is soluble in alcohol, ether, and chloroform; almost insoluble in water; but releases a large proportion of iodine when brought into contact with water. It is said to be very destructive to the staphylococcus aureus, but, according to Dr. W. Siebel, its physiological action depends upon the iodine which it liberates. It discolors, and, if left long in contact with the skin, produces irritation. Iodine poisoning is liable to result even from small doses of the compound, when given by the mouth.

Iodipin is a trade designation for a solution of iodine in sesame-oil (10 per cent.) analogous to bromipin. The taste of the preparation is rather unpleasant, but patients are said not to object to it after they have become accustomed to it. Iodipin is taken internally for the same purpose as other iodine preparations: for struma, cold abscesses, etc. It may also be administered subcutaneously, 50 c.cm. (or f3xiiss) daily being employed in children. The dose by the mouth, in children, is 4 c.cm. (or f3j) three times daily. Klingmüller claims especial advantages in the treatment of tertiary syphilis by the subcutaneous use of iodipin. For hypodermic use, a 25-per-cent. iodipin is employed. It also may be used for inunction, in struma, tuberculosis, and syphilis.

Iodo-eigon (alpha-eigon) is a pale-brown powder, tasteless and odorless, containing, it is said, 20 per cent. of iodine. It is used as a wound dressing as a substitute for iodoform, but is claimed to be a more efficient disinfectant. It is insoluble in water, but mixes with the secretions, forming an emulsion-like dressing. It may be employed suspended in water as an injection into sinuses, or simply dusted upon the wound surface. (See also **Eigon.**)

Nosophen.—This compound, obtained by the action of iodine upon a solution of phenolphthalein, is a light-yellow powder free from odor or taste, and contains 60 per cent. of iodine. It is insoluble in water, and combines with metals to form salts. Nosophen has been used in rhinitis, after operations upon the nasal cavity, and in venereal affections.

IPECACUANHA (U. S. P.).—**Ipecac.**

IPECACUANHÆ RADIX (B. P.).—**Ipecacuanha-root.**

Dose, as an expectorant, 0.015 to 0.13 Gm. (or gr. $^1/_4$-ij); as an emetic, 1 to 2 Gm. (or gr. xv-xxx).

U. S. P. Preparations.

Fluidextractum Ipecacuanhæ.—Fluid Extract of Ipecac. Dose, as an expectorant, 0.03 to 0.12 c.cm. (or *m*ss-ij); as an emetic, 1 to 1.20 c.cm (or *m*xv-xx).

Syrupus Ipecacuanhæ.—Syrup of Ipecac. Dose, 4 to 7.5 c.cm. (or f3i-ij).

Vinum Ipecacuanhæ.—Wine of Ipecac. Dose, 0.60 to 4 c.cm. (or *m*x-f3j).

Pulvis Ipecacuanhæ et Opii.—Powder of Ipecac and Opium, Dover's Powder (1 part each of opium and ipecac and 8 parts of sugar of milk). Dose, 0.13 to 0.65 Gm. (or gr. ii-x).

Tinctura Ipecacuanhæ et Opii.—Tincture of Ipecac and Opium (deodorized tincture of opium, 100; fluid extract of ipecac, 10; diluted alcohol, q. s. to make 100 c.cm.). Dose, 0.06 to 1 c.cm. (or *m*i-xv).

B. P. Preparations.

Extractum Ipecacuanhæ Liquidum.—Liquid Extract of Ipecacuanha. Dose, as an expectorant, 0.03 to 0.12 c.cm. (or *m*ss-ij); as an emetic, 1 to 1.20 c.cm. (or *m*xv-xx).

Acetum Ipecacuanhæ.—Vinegar of Ipecacuanha (liquid extract, 5; alcohol, 90 per cent., 10; dilute acetic acid, 85). Dose, 0.60 to 2 c.cm. (or *m*x-xxx).

Vinum Ipecacuanhæ.—Ipecacuanha-wine. Dose, as an expectorant, 0.60 to 2 c.cm. (or *m*x-xxx); as an emetic, 15 to 22 c.cm. (or f3iv-vj).

Trochiscus Ipecacuanhæ.—Ipecacuanha Lozenge (0.016 Gm., or gr. $^1/_4$, to each lozenge). Dose, 1 or more.

Trochiscus Morphinæ et Ipecacuanhæ.—Morphine and Ipecacuanha Lozenge (morphine hydrochloride, 0.0018 Gm., or gr. $^1/_{36}$; ipecacuanha-root, 0.005 Gm., or gr. $^1/_{12}$). Dose, 1 or more.

Pulvis Ipecacuanhæ Compositus.—Compound Powder of Ipecacuanha, Dover's Powder (1 part each of opium and ipecacuanha and 8 parts of potassium sulphate). Dose, 0.32 to 1 Gm. (or gr. v-xv).

Pilulæ Ipecacuanhæ cum Scilla.—Pill of Ipecacuanhæ with Squill (compound powder of ipecacuanha, 3; squill, in powder, 1; ammoniac, in powder, 1; syrup of glucose, to make a mass). Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Pharmacology.—The dried root, to which may be attached a portion of the stem not exceeding 7 cm. in length, of Cephaëlis Ipecacuanha of A. Richard" (Rubiaceæ), known commercially as Rio, Brazilian, or Para Ipecac, or the corresponding portion of C. acuminata, Karsten, known commercially as Carthagena Ipecac, yielding when assayed not less than 2 per cent. of ipecac alkaloids. In the British Pharmacopœia it is called Psychotria Ipecacuanha. Ipecac-root contains about 3 per cent. of an alkaloid, **Emetine,** and a glucoside, **Ipecacuanhic acid,** with a trace of volatile oil, tannin, starch, gum, etc. Owing to the scarcity of the Rio root (C. Ipecacuanha), the cheaper Carthagena variety (C. acuminata) is now generally used. The former contains Emetine, the more purely expectorant principle, in excess; the latter contains Cepæline, the more purely emetic principle, in excess.[1] Recent experiments seem to show that emetine is not homogeneous, but is a mixture of two or more different substances. Paul and Cownley confine the name **emetine** to the amorphous alkaloid, and state that it properly is **methyl-cepæline,** the crystallizable alkaloid being named **cepæline.**. Emetine is slightly soluble in water, but it dissolves readily in ether, alcohol, and chloroform.

Physiological Action.—The prolonged application of ipecac to the skin causes irritation, followed by vesicles, pustules, or even ulcers. Inhalation of the powdered root irritates the air-passages and occasions coryza, or, in some persons, an asthmatic attack. The powdered root has a slight, but characteristic and nauseous, taste. Taken into the mouth, it increases the salivary secretion and excites nausea; and, in the stomach, in a similar way, small doses (0.015 Gm., or gr. $^1/_4$) promote secretion, while large ones cause nausea and vomiting. Ipecac is a systemic emetic, and causes vomiting when swallowed, and also when injected hypodermically in the form of fluid extract, or the alkaloid, **Emetine.** This drug has a peculiar effect upon the pulmonary circulation, sometimes causing hyperæmia, and at others reducing the amount of blood in the lungs and producing relative anæmia. Small doses stimulate the liver, and larger ones, after tolerance has been established, act as cholagogic cathartics. The active principle is excreted by the liver and gastro-intestinal tract. The skin is relaxed and perspiration increased; the secretions of the broncho-pulmonary mucous membrane are also increased. No marked effect upon the circulation is noticed, but emetine exercises a solvent action upon the red corpuscles when injected into a

[1] *New York Medical Journal,* 1905, p. 1330.

vein. The pulse is reduced in tension as a result of the act of vomiting, which also favors diaphoresis. Urticaria is occasionally caused by the internal use of ipecacuanha.

Therapy.—Ipecac has been used externally with benefit for insect-bites.

In the dermatitis caused by rhus toxicodendron the free application of a wash containing powdered ipecac in the proportion of 12 Gm. to 473 c.cm. (or ʒiii-Oj) of water, is warmly recommended by Dr. W. S. Gilmore. In the form of a spray with a hand-atomizer a dilute solution of the wine of ipecac, as recommended by Murrell and Ringer, is of great service in emphysema, fibroid phthisis, chronic bronchitis, and winter cough, in allaying the spasmodic vomiting and liquefying the secretions. Ringer dilutes the wine with 1 or 2 parts of water, and, using an ordinary hand-atomizer, twenty or more squeezes of the bulb are made, and the spray deeply inhaled, once daily at first, afterward more frequently. The mouth should be well rinsed out afterward and a piece of lemon-peel chewed to avoid a nauseating effect. When fractional doses of wine of ipecac are administered (0.06 c.cm., or *m*j, every hour or half-hour) they may act as a stimulant, and overcome obstinate vomiting and retching, just as small doses of brandy do. In the vomiting of pregnancy it is said that a single drop, taken every hour, is curative; it certainly makes a decided mental impression, and also may overcome the morbid action of the stomach by substitution. Bartholow, however, declared that it had always failed in his hands. In hæmoptysis, small doses of the following combination have sometimes proved of service:—

℞ Pulveris ipecacuanhæ	1	75 Gm. or gr. xij.
Bismuth. subnit.		55 Gm. or gr. xxiv.
Creosoti		37 c.cm. or *m*vj.

M. et ft. chartulæ no. xij.
Sig.: A powder every hour or two until relieved.

In hæmoptysis small doses of the powder, short of producing vomiting, serve to reduce the bleeding by decreasing the pulmonary congestion. It has also given good results in the treatment of epistaxis and uterine hæmorrhages. The fact that small doses of ipecac have a favorable influence in arresting and preventing hæmoptysis induced Onimus to apply the same treatment to metrorrhagia, and he recently announced at the Paris Société de Biologie that he had found it remarkably effective.

The wine of ipecac has been successfully employed in doses of 0.60 to 1 c.cm. (or *m*x-xv) for the purpose of overcoming uterine inertia in the first and second stages of labor. It is said that the drug does not excite tetanic contraction, but normal and regular expulsive efforts.

An attack of asthma may be cut short by full doses of ipecac, and an occasional emetic is useful in whooping-cough and capillary bronchitis to dislodge the secretions. Bond[1] reports excellent results in a case of epilepsy from ipecacuanha, beginning with 0.60 c.cm. (or *m*x); the dose was gradually increased to 2.30 c.cm. (or *m*xxxvj) three times a day. The severity and frequency of the fits gradually diminished for a year, and then ceased entirely.

When, in bronchitis, the secretions are viscid and the cough hard, ipecac in combination with other expectorants is generally resorted to. The appended formulæ containing ipecac are to be recommended in bronchitis:—

[1] *Lancet*, Sept. 17, 1898.

℞ Vini ipecacuanhæ ..... 7 | 5 c.cm. or f3ij.
Syrup. scillæ ..... 60 | c.cm. or f℥ij.
Tinct. opii camph. ..... 15 | c.cm. or f℥ss.
Glycerini .....q. s. ad 150 | c.cm. or f℥v.
M. Sig.: One or two teaspoonfuls whenever necessary for the relief of cough.

℞ Syrup. ipecacuanhæ ..... 15 | c.cm. or f℥ss.
Ammonii chloridi ..... 8 | Gm. or 3ij.
Spiritus ætheris nitrosi ..... 45 | c.cm. or f℥iss.
Morphinæ sulphatis ..... | 065 Gm. or gr. j.
Syrup. pruni Virg. .....q. s. ad 150 | c.cm. or f℥v.
M. Sig.: Two teaspoonfuls every hour or two for the relief of cough.

For bronchitis, especially of elderly persons, ipecacuanha can be combined thus with advantage:—

℞ Syrup. ipecacuanhæ ..... 30 | c.cm. or f℥j.
Potassii nitratis ..... 8 | Gm. or 3ij.
Creosoti ..... | 30 c.cm. or *m*v.
Glycerini,
Aquæ aurantii florum ..... aa 60 | c.cm. or f℥ij.
M. Sig.: Two teaspoonfuls in water every two or three hours.

In croup, especially where the mucus is not expelled, but is swallowed or accumulates in the air-passages, an emetic dose of syrup of ipecac often gives great relief and may prevent suffocation. For cases of this kind, it is much superior to tartar emetic or the compound syrup of squill, also containing this salt, which is too depressing. In delirium tremens, or acute alcoholic poisoning, ipecac produces evacuation of the contents of the stomach and stimulates the action of the liver. It is too slow in its action as an emetic to be of much service in other forms of poisoning. In dysentery, 2.60 to 4 Gm. (or gr. xl-lx) are given with wonderfully successful results; if necessary to quiet the stomach an opiate is administered about twenty minutes previously; no liquids swallowed for an hour after the ipecac has been taken, and absolute rest in the recumbent posture observed. The same treatment is useful in cholera morbus, and has been recommended in Asiatic cholera.

Ipecac deprived of its emetine has been found by East-Indian physicians equally efficient in dysentery. It is administered in about the same doses as ipecac and is less apt to excite nausea or vomiting. In dysenteric diarrhœa, when blood and mucus appear in the stools, small doses may be given, combined with opiates or Dover's powder. Ipecac, with mercury and opium, often acts well in both diarrhœa and dysentery:—

℞ Pulveris ipecacuanhæ et opii ..... 4 | Gm. or 3j.
Massæ hydrargyri ..... | 65 Gm. or gr. x.
Camphoræ,
Pulveris capsici,
Pulveris kino ..... aa 1 | Gm. or gr. xv.
M. et ft. pil. no. xxx.
Sig.: One or two pills every hour or two until relieved.

Ipecac has been used in tuberculous diarrhœa with alleged advantage. It is said to have the power of restraining night-sweats.

Emetine has been successfully used in diarrhœa due to indigestion. It is given in the dose of 0.0002 Gm. (or gr. $^1/_{300}$), preceded by a calomel purge. Nausea disappears and diarrhœa is rapidly controlled.

Ipecac is also used in fractional doses for insufficient excretion of bile and torpor of the liver, and may be combined with extract of digitalis, or other agents, as follows:—

℞ Pulv. ipecacuanhæ		25 Gm. or gr. iv.
Quininæ hydrochlorat.	4	Gm. or 3j.
Pepsin.	1	55 Gm. or gr. xxiv.
Olei eucalypti		18 c.cm. or *m*iij.

M. et ft. pil. no. xxiv.
Sig.: Take one after meals.

Small doses of ipecac, given after meals, are of service in flatulent dyspepsia. When the tongue is heavily coated and the stomach contains indigestible food, especially at the beginning of a fever, an emetic dose of ipecac will prove very serviceable in relieving symptoms; it is a means of treatment that has been allowed to fall into undeserved neglect. In the treatment of malarial poisoning, this method of stimulating the liver is very useful previous to the administration of quinine or other antiperiodics. It is of service likewise in the treatment of catarrhal jaundice.

In laryngismus stridulus, an emetic of syrup of ipecac usually aborts the paroxysm and affords time for the use of potassium bromide to produce its effects. Trousseau recommended its use in the puerperal state, in cases of post-partum hæmorrhage, and dysentery, etc. In other forms of hæmorrhage, such as epistaxis, menorrhagia, and metrorrhagia, ipecac is serviceable when given in doses sufficient to provoke vomiting. Dr. C. Burland testifies to its value in controlling hæmatemesis. He administers it in the dose of 4 Gm. (or 3j) or more, made into a bolus with enough glycerin to produce the necessary consistency.

The **Euphorbia Ipecacuanha** (Euphorbiaceæ), Ipecacuanha spurge, growing in the eastern part of the United States, from New York southward, although belonging to a different natural order, yet contains in its root an emetico-cathartic principle, which renders it a good substitute for ipecac where emesis is required and catharsis is not objectionable. It is commonly administered in the form of powdered root, but a fluid extract may also be obtained. It is of more agreeable taste than ipecac.

IRIS.—Iris (Blue Flag).

Dose, 0.20 to 0.25 Gm. (or gr. iii-iv).

Preparations.

Extractum Iridis.—Extract of Iris. Dose, 0.015 to 0.065 Gm. (or gr. $^1/_4$-j).
Fluidextractum Iridis.—Fluid Extract of Iris. Dose, 2 to 4 c.cm. (or *m*xxx-f3j).

Pharmacology.—The Iris versicolor (Irideæ) is a common inhabitant of moist places and borders of ponds of the United States, and is one of the most attractive among our wild flowers. It is an herbaceous perennial, with a thickened root-stock. The dried rhizome and roots were formerly official in the United States Pharmacopœia (Revision of 1890). The flowers are large and showy, violet-blue, variegated with greenish-yellow and white, with purple veins; they appear in May and June. It contains an acrid resin, upon which its medical activity depends, besides ordinary vegetable principles. **Iridin** is an impure resin, precipitated from alcoholic tincture by water.

Physiological Action.—The powdered root, when fresh, is a powerful emetic and cathartic, less so after drying. It is a decided cholagogue, and also diuretic and alterative, having a stimulant action upon the intestinal glands. It is best given in combination with aromatics and milder purgatives.

Therapy. — In chronic hepatic derangements, especially of malarial origin, the preparations of blue flag are very useful, and particularly the recent saturated tincture. In duodenal catarrh, obstructive jaundice, bilious remittents, iris preparations are frequently used with advantage. In dropsy they are also useful, both as diuretics and cathartics. Iris, administered in small doses, is very beneficial in sick headache dependent upon indigestion. In larger doses it has vermifuge properties and may be used to expel the round worm, ascaris lumbricoides.

℞ Fluidext. iridis,
Fluidext. hydrastis ..... aa 15 | c.cm. or f℥ss.
Elixir aromatic. ..... 30 | c.cm. or f℥j.
M. Sig.: Take a dessertspoonful in hot water before meals for indigestion.

IRIS FLORENTINA. — Orris-root. Several species of the genus Iris (Irideæ) furnish the rhizome known by the name of orris-root. It contains a volatile oil of violet color and pleasant odor, much used in perfumery; besides an acrid resin, starch, mucilage, etc. The powder, which is said to be alterative, cathartic, and diuretic, is rarely employed internally, but is used in making sachets, tooth-powders, and in alcoholic tincture, in perfumery and flavoring extracts.

ISO-ETHYLIN is the name of a new antiseptic formed by the destructive distillation of ethyl alcohol, as formaldehyd is produced from methyl alcohol, and possesses some of the characteristics of the latter. Its germicidal power, however, is slightly below that of formaldehyd. Dr. G. M. Randall, of Augusta, Me., hopes it will prove capable of keeping milk from spoiling, while harmless. Experiments lately made on animals led him to believe that, in minimum strengths capable of arresting bacterial growths, the iso-ethylin does not interfere with digestion. Being volatile at 100° F., he thinks that the body-temperature is sufficient to drive it out of the milk and thus keep it from interfering with the action of the gastric juice.

IZAL.—Izal is a by-product obtained in the manufacture of coke. It was found by Dr. Klein, of London, that a 1 to 200 solution was destructive, within five minutes, to various species of microbes. It is not irritant, however, in this strength to the human integument. This solution has been used for the purpose of disinfecting sponges and instruments, and for impregnating gauze intended as a dressing to wounds.

JABORANDI FOLIA (B. P.).—(See **Pilocarpus**, U. S. P.)

JALAPA (U. S. P., B. P.).—**Jalap.**
Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Preparations.

Resina Jalapæ (U. S. P., B. P.).—Resin of Jalap. Dose, 0.065 to 0.25 Gm. (or gr. i-iv).

Extractum Jalapæ (B. P.).—Extract of Jalap. Dose, 0.13 to 0.32 Gm. (or gr. ii-v).

Pulvis Jalapæ Compositus (U. S. P., B. P.).—Compound Powder of Jalap (U. S. P. contains jalap, 35 Gm.; cream of tartar, 65 Gm.). Dose, 0.65 to 4 Gm. (or gr. x-3j).

Tinctura Jalapæ (B. P.).—Tincture of Jalap (contains 1.5 Gm., or gr. xxiij, of resin in 100 c.cm., or f3xxvij). Dose, 2 to 4 c.cm. (or f3ss-j).

Pharmacology. — "The tuberous root of Ipomœa Jalapa (Convolvulaceæ)," obtained from Mexico, contains not less than 8 per cent. of resin (U. S. P.); "the dried tubercules of Ipomœa Purga," and should yield not less than 9 nor more than 11 per cent. of resin (B. P.). The resin is official and composed of **Jalapin,** a soft resin soluble in ether, and **Convolvulin,** a hard resin insoluble in ether, the latter of which has been found to be the more active; also starch and sugar, of each about 18 per cent. According to Professor Poleck, jalapin is a resinous glucoside, and separates by the action of hydrochloric acid into sugar and jalapinolic acid. G. A. Kayser found that the resin is composed of a hard and a soft portion: the former, constituting 70 per cent., is called **Rhodeoretin** (identical with **Jalapin**). This substance purges violently in small doses (0.20 to 0.25 Gm., or gr. iii-iv), and is the most important active principle. It was renamed by Mayer, who called it **Convolvulin.** Poleck suggests the name **Orizabin,** as a substitute for Jalapin, and confirms the statement that this resin is identical in composition and chemical properties with scammonin.

Physiological Action. — Jalap is an hydragogic cathartic, increasing the intestinal secretions and the flow of bile; overdoses may produce hypercatharsis and prostration. Convolvulin is an irritant, and may cause gastro-enteritis and collapse; it is a local purgative, and is not excreted in the urine or fæces, but is probably destroyed by oxidation or by the hepatic cells.

Therapy.—The compound powder of jalap is one of the best hydragogic cathartics for dropsy, either of heart or kidney disease; and in cases of pulmonary congestion and distended right heart, with lividity, shortness of breath, and so-called cardiac asthma, a teaspoonful of compound jalap-powder affords great relief.

In dropsy dependent upon cardiac or renal disease, Prof. Joseph Jones, of New Orleans, employed with advantage a diuretic and purgative wine thus composed:—

℞ Fluidext. jalapæ,			
Fluidext. scillæ	aa 11		c.cm. or f3iij.
Fluidext. pilocarpi	30		c.cm. or f℥j.
Fluidext. digitalis	2		c.cm. or *m*xxx.
Potass. nitrat.	15	5	Gm. or 3iv.
Vini Angelicæ	1000		c.cm. or Oiif℥ij.

M. Sig.: A tablespoonful every three hours. The quantity can be gradually increased if necessary.

As an ordinary laxative, the compound powder of jalap may be combined with compound licorice-powder where the latter fails alone, and is a good cathartic for children. Jalap may be used as a cathartic after administration of santonin or calomel, or where a tæniacide has failed to bring away the parasite. As a purgative, it is sometimes combined with calomel, but, as it acts more rapidly than the latter, the effect of the mercurial is lost unless it precedes the former from four to six hours. Jalap is not so rapid in its action as croton-oil, but is more manageable. In hæmorrhoids it does not

cause increased irritation, but relieves them by emptying the vessels above and clearing out the liver.

Convolvulin is an efficient purgative and may be prescribed in doses from 0.10 to 0.20 Gm. (or gr. iss-iij).

JAMBOL.—Jambol. The Eugenia jambolana (Myrtaceæ) is a tree indigenous to tropical America and the West and East Indies, where the acid fruit is eaten as food and as a remedy for diarrhœa and diabetes by the natives. It has also been used to some extent in Europe in the form of an extract in the treatment of diabetes. In some experiments[1] made in Professor Binz's laboratory, it was shown by Dr. C. Graeser that in dogs in which diabetes had been artificially induced by the administration of phloridzin, the simultaneous exhibition of jambol reduced the proportion of sugar materially (80 to 85 per cent.). There were no signs of toxic action after administration of large doses, 6 to 18 Gm. (or 3iss-ivss) daily, of extracts partly made from the whole fruit and partly from the rind or kernel. Mr. Thomas Stephenson also finds that jambol possesses the power of checking the action of diastasic ferments in converting starch into grape-sugar. The result of his experiments was to show conclusively that the greatest influence over the action of diastase was exerted by a preparation of the fresh kernels by a process avoiding the use of heat. The difference in the preparations made use of by different observers probably explains the varying results reported.

Scott added powdered jambol to malt and starch, and found that the formation of sugar was prevented. M. Villie, however, who repeated the experiment, obtained more sugar when jambol was present than when it was absent. Hildebrandt states, as the result of his experiments, that jambol prevents the action of plant-diastase and the sugar-forming ferments in the blood-serum, saliva, and pancreatic extract, but is without effect upon pepsin and trypsin. Many reports, for the most part favorable, have been made in regard to the efficacy of jambol in the treatment of diabetes mellitus. In the majority of cases the amount of urine was reduced, the proportion of sugar lessened and the general health improved under its use. In a number of instances this amendment has taken place in the absence of the usual regulation of diet. In pancreatic diabetes, on the other hand, Dujardin-Beaumetz asserted that the quantity of sugar in the urine is actually increased. This writer regarded the drug as merely an adjuvant to the dietetic management of moderately-severe cases of diabetes. Though the evidence of different observers is not always in accord, yet from what has been published the drug certainly merits a trial and the closest study of its therapeutic worth. In India jambol has long been esteemed of value in diarrhœa.

JOHIMBIN is derived from the bark of the johimbehe-tree of the Cameroons. Berger[2] writes of his success with this drug as an aphrodisiac. He cites 7 cases; 5 patients were suffering from "paralytic impotence"; the remaining 2 were healthy individuals (sexually) and received the treatment to demonstrate its harmlessness. The writer prepared a solution containing 0.01 Gm. to 20 c.cm. (or gr. $^1/_6$-f3vss) of water, of which 1.20 c.cm. (or *m*xx)

[1] *Lancet*, Nov. 2, 1889; *Therapeutic Gazette*, Jan., 1890.
[2] *Deutsche medicinische Wochenschrift*, April 25, 1901.

was given as a dose. The exhibition of the drug produced erections and power for coitus in a few days. Berger also states that if no reaction is obtained within a week the dose should be increased to 2.50 to 4 c.cm. (or *m*xl-lx). A. Eulenberg has used johimbin in cases of neurasthenic impotence with excellent results in doses of 0.60 c.cm. (or *m*x) of a 1-per-cent. solution. In some of the cases the effect of the drug passed off after a time and required a repetition of the treatment. In animals the drug produces a swelling of the testes and erections and large doses, 0.01 Gm. (or gr. $^1/_6$), had no deleterious effect upon the general health of the animal.

JUGLANS.—Juglans (Butternut).
Dose, 4 to 8 G. (or ʒi-ij).

Preparation.

Extractum Juglandis.—Extract of Butternut. Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Pharmacology. — The bark, collected in the autumn, of the root of Juglans cinerea (Juglandaceæ), a large tree of North America, contains **Nucin** or **Juglandic acid** (resembling chrysophanic acid), also resin, volatile oil, and fixed oil and tannin.

Therapy.—It is a mild cathartic, useful in chronic constipation and dysentery.

Nut-oil is the fixed oil obtained by expression from the crushed seeds of several species of Juglandaceæ. Walnuts and hickory-nuts yield about 25 per cent. of a fine, bland, pleasant-tasting oil, which can be used in pharmacy, or in medicine for massage, like other fixed oils. It is a drying oil, containing linolein.[1]

A decoction of walnut-leaves, used both externally and internally, is said by Dr. Rodionoff to be of value in scrofula.

JUNIPERUS.—Juniper, Juniper-berries.

Preparations.

Spiritus Juniperi Compositus (U. S. P.).—Compound Spirit of Juniper (oil of juniper, 8; oil of caraway, 1; oil of fennel, 1; alcohol, 1400; water, q. s. ad 2000 c.cm.). Dose, 7.5 to 15 c.cm. (or fʒii-iv).

Spiritus Juniperi (U. S. P., B. P.).—Spirit of Juniper (oil of juniper, 5; alcohol, 95 c.cm.). Dose, 4 to 15 c.cm. (or fʒi-fʒss). B. P., 1.20 to 4 c.cm. (or *m*xx-fʒj).

Oleum Juniperi (U. S. P., B. P.).—Oil of Juniper. Dose, 0.30 to 1.20 c.cm. (or *m*v-xx). B. P., 0.03 to 0.18 c.cm. (or *m*ss-iij).

Pharmacology.—The fruit of Juniperus communis (Pinaceæ), an evergreen of this country and northern Europe, contains from 2 to 2 $^1/_2$ per cent. of a **volatile oil,** about 15 to 30 per cent. sugar, etc.; also a non-crystallizable principle, **Juniperin.** The volatile oil also exists in the leaves and other parts of the plant, and by macerating them in alcohol or spirits a liquor is produced, commonly known as gin, or spiritus Genevæ. As the commercial article is frequently adulterated with oil of turpentine and other ingredients known to the trade, the U. S. Pharmacopœia offers a substitute in the compound spirit of juniper. The oil of juniper obtained from

[1] "A Companion to the U. S. Pharmacopœia," Oldberg & Wall, New York, 1887.

the wood is inferior to that distilled from the berries, which is the official form from which the spirit and compound spirit are made.

Physiological Action.—Juniper stimulates the kidneys, but in health, while the discharge of urea is increased, the urinary water may be actually diminished temporarily; an overdose producing strangury and suppression of urine. In diseased conditions, however, the flow of urine is much more free, and especially where dropsy exists. The oil is carminative as well as diuretic, and in alcoholic solution is a frequently-used stimulant. It is contra-indicated in acute inflammation of the kidneys.

Therapy.—In various forms of dropsies, juniper is useful. In the form of an infusion, to which 15.5 Gm. (or ℥ss) of cream of tartar is a good addition, a pint being drunk through the day, the effects are soon manifest in Bright's disease and its attendant œdema and effusions. A combination with potassium acetate is also very effective, as:—

℞ Potassii acetatis	23	3	Gm. or ʒvj.
Spiritus juniperi comp.	45		c.cm. or f℥iss.
Infusi scoparii	135		c.cm. or f℥ivss.

M. et ft. sol.
Sig.: A tablespoonful three or four times a day.

Juniper gives relief in passive congestion of the kidneys and the lumbar pain which accompanies that condition. This remedy is inappropriate, however, in acute nephritis, on account of its stimulant properties. In large doses it sometimes excites priapism, strangury, or hæmaturia. Benefit is obtained from juniper in chronic pyelitis, prostatorrhœa, and gleet. Chronic catarrh of the bladder is also relieved by its use.

The juice of the berries has been successfully used in doses of 7.5 to 11 c.cm. (or f℥ii-iij) as a diuretic for young children and in renal dropsy. The oil may be dropped in boiling water and inhaled to produce the same effect. In infantile colic a few minims of the compound spirit in hot water relieves flatulence and pain.

Juniper-wood by destructive distillation yields an oil known as oil of cade, official in both the United States and British Pharmacopœias (see **Oleum Cadinum**).

KAMALA.—Kamela (Rottlera).

Pharmacology and Therapy.—"The glands and hairs from the capsules of Mallotus philippinensis (Euphorbiaceæ)," a small tree of India and China, come to this country in the form of a finely-granular powder. It was dropped from the last revision of the United States Pharmacopœia. Kamala is inflammable, and is insoluble in cold and nearly so in hot water, but is largely soluble in alkaline solution, alcohol, and ether. From these solutions a resin is precipitated by the addition of water. Kamala is liable to be largely adulterated. The resinous material consists of several distinct principles, the most important of which is called **Rottlerin**, which is obtained by exhausting the drug with ether. In full doses, 4 to 12 Gm. (or ʒi-iij), it is a drastic purgative, and in India it is used largely as a vermicide. For tape-worm the quantity named is given at a dose, mixed with molasses or other vehicle, with a little hyoscyamus to prevent griping, and its operation may be made more active by a dose of castor-oil, given after the last portion of kamala. A fluid

extract and a tincture (6 to 16 unofficial) are also used to expel lumbricoid worms. In the form of ointment kamala is used in the East in the treatment of scabies and ringworm.

KAOLINUM (U. S. P., B. P.).—**Kaolin** ($Al_2[S_1O_3]_3 + Al_2O[OH]_4$). Fuller's earth.

CATAPLASMA KAOLINI (U. S. P.).—**Kaolin Cataplasm.**

A native aluminum silicate, powdered and freed from gritty particles by elutriation. Porcelain clay is employed in medicine as a dusting-powder for intertrigo and eczema, to relieve irritation, and protect the surface from the air. It is employed pharmaceutically in pills as an excipient for silver nitrate, potassium permanganate, etc. The cataplasm contains glycerin as an excipient, with boric acid, methyl salicylate, and oil of peppermint. It has been found useful in relieving cellulitis, and in inflammation of internal organs. It should be applied warm and confined with a bandage.

KAVA-KAVA.—Methysticum. The Macropiper latifolium (Piperaceæ) is a shrub of the Hawaiian Islands, having a large root, which yields about $2^1/_2$ per cent. of soft **resin** (consisting of two kinds, distinguished as **a** and **b**); about 1 per cent. of a neutral, crystalline principle, **methysticin** (or kavahin); and some yellow, volatile oil. This resembles piperine and cubebin, and is probably inert, the medicinal qualities depending upon the resins and volatile oil. It is best given in the form of a tincture or fluid extract (N. F.), made with alcohol as a menstruum.

Physiological Action.—In the Hawaiian Islands the natives prepare an intoxicating beverage by chewing the root and infusing it with water or cocoa-nut-milk to grace their festivals. In consequence of prolonged use Lutz has observed that the skin of the Islanders, especially upon the extremities, assumes a decidedly ichthyotic appearance, associated with a certain degree of atrophy resembling that of old persons.

The physiological action of kava-kava has been investigated by Lewin, Randolph, and others. Dr. David Cerna has published an account of a series of experiments[1] upon the same subject. When the fluid extract or the resin is placed upon the tongue, a burning sensation is at first produced, soon followed by an increase of saliva and local anæsthesia. The loss of sensation endures for hours, and normal sensibility slowly returns. The same benumbing influence is exercised upon the cornea and conjunctiva by a local application. A few minims of a solution injected hypodermically caused complete anæsthesia in the neighboring parts. The loss of sensibility persisted for a week.

The mucous membrane is rendered anæmic. Taken internally in considerable quantity, it induces somnolence. As the result of his researches, Cerna concludes that kava-kava produces general anæsthesia, and is especially a powerful local anæsthetic. It diminishes and finally destroys the action of the afferent nerves by affecting their peripheral ends. Reflex action is diminished and ultimately abolished. Paralysis of spinal origin is an effect of the drug. The action of the heart is rendered slower and more powerful; arterial pressure is at first reduced and subsequently raised. Respiration is

[1] *Therapeutic Gazette*, Jan. 15, 1891.

at first stimulated, afterward depressed, and finally paralyzed. Small doses of kava-kava slightly increase, while large quantities reduce, bodily temperature.

Therapy.—In cystitis and chronic gonorrhœa, kava-kava is often remarkably successful. Acute gonorrhœa, retention of urine, and incontinence of urine have also been notably ameliorated by the exhibition of this remedy unaided by any other form of treatment. It is likewise beneficial in leucorrhœa and vaginitis. It has also been recommended for gout. It is suggested that the anæsthetic properties of this substance may prove useful to dentists, and that, though irritant to the conjunctiva, it may be employed subsequent to cocaine for the purpose of prolonging the anæsthesia due to the alkaloid, and may be used, also, to disguise the taste of bitter or nauseous medicines.

KEFIR.—Kefir is a product of the fermentation of milk, brought to general professional notice by the writings of Russian physicians. It is prepared by the natives of the Caucasus by the addition of a ferment collected from a mountain-bush. The ferment consists of bacilli and yeast-cells, the latter alone being essential to the fermentation. Kefir is a pleasantly-acid fluid, containing 8 parts of alcohol and 9 parts of lactic acid in 1000 parts.

Therapy.—Kefir is well tolerated by the stomach and has been employed with good results in the treatment of dyspepsia, gastric catarrh, gastric ulcer, anæmia, chlorosis, and scrofulosis. It is useful in maintaining nutrition in pulmonary tuberculosis and cancer of the stomach.

KINO (U. S. P., B. P.).—**Kino.**
Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Preparations.

Tinctura Kino (U. S. P., B. P.).—Tinctura of Kino (5, or B. P., 10 per cent.). Dose, 4 to 7.5 c.cm. (or f3i-ij).

Pulvis Kino Compositus (B. P.).—Compound Powder of Kino (kino, 75; opium, 5; cinnamon, 20). Dose, 0.32 to 1.30 Gm. (or gr. v-xx). This powder contains 5 per cent. of opium.

Pharmacology.—Kino is "the inspissated juice of Pterocarpus Marsupium (Leguminosæ)": a tree of the East Indies. It occurs in fragments of a ruby-red color, without odor, of a sweetish, astringent taste; scarcely soluble in cold, but entirely soluble in boiling water; soluble also in alkalies. **Kinotannic acid** is the most important constituent; there are also present **Kinoin**, a crystalline neutral substance, **Pyrocatechin, Pectin,** etc. The official kino is the so-called Malabar kino; there are other varieties, notably one from Botany Bay, obtained from several species of eucalyptus.

Physiological Action and Therapy.—Kino is a mild astringent, useful in diarrhœa, especially with chalk mixture and paregoric. Kino, locally and internally, possesses some value as an hæmostatic, and is a serviceable remedy in pyrosis. The tincture is often an ingredient of injections in gonorrhœa, and may be applied as a stimulant dressing to chronic ulcers. The compound powder (B. P.) is used especially for gastro-intestinal disorders attended by diarrhœa. It has 5 per cent. of opium. Kino may also be employed in solution as a gargle, but has no advantage over tannic acid for this purpose.

KOLA.—Cola. The recent or dried cotyledons of Cola vera, or of Cola acuminata (Sterculiaceæ) are used by the natives in various parts of Africa. The seeds are chewed, and from the powdered dried seeds an agreeable stimulant and nutritious beverage is prepared with milk and honey. The tree grows to the height of thirty to sixty feet, bears some resemblance to the horse-chestnut, is a native of the western coast of Africa, and is found as far inland as five hundred or six hundred miles. It has been introduced, and with success, into other tropical regions of Asia and South America. From five to fifteen seeds, some red and others white, are contained in a single capsule. They contain a large proportion of **caffeine** or **theine** (2.348 per cent.), together with tannic acid and theobromine (0.023 per cent.), other constituents being sugar, albumin, cellulose, starch, fat, and fixed salts. According to the investigations of Dr. E. Knebel, confirmed by A. Hilger, the fresh nut contains no caffeine, but a glucoside which, by decomposition, gives rise to caffeine, glucose, and kola-red.

These seeds have lately been employed in a number of clinical experiments. An alcoholic extract has been made by exhausting the fresh nuts with 5 parts of 60° alcohol, and a wine by macerating in a sweet white wine for a fortnight. But neither of these preparations extract all the caffeine. A tincture and a syrup have also been made, though water is an imperfect menstruum on account of the starch contained in the seeds. According to Simmonds,[1] there is also a false or bitter kola, the male kola, named also the Garcinia kola, the seeds of which are oval or cuneiform; these are four in number, contained in a large berry. The false kola-nuts are destitute of alkaloid.

Physiological Action. — The taste of the fresh seed is at first sweet, becoming astringent and slightly bitter. From his investigations upon himself and others, R. H. Firth concludes that kola increases the secretion of urine, stimulates the nervous system and heart, and increases arterial tension. It prevents the feeling of exhaustion from exercise or hunger. It communicates an agreeable taste to water or food, and, according to Armitrous, renders tainted meat edible and clarifies polluted water by a mechanical action.

Dr. Kotliar studied the action of kola-nut upon seven healthy young men during periods of rest and work, 4 Gm. (or ʒj) of the powdered nut being given daily to each subject. Both during rest and work the assimilation of phosphorus and sulphur was increased. The metamorphosis of the same elements was diminished during rest and at work, but more particularly during rest. The breaking up of phosphorus and sulphur compounds during periods of repose and labor, as compared with that of nitrogenous compounds, was diminished. The assimilation of chlorine was increased during rest, but unaltered during work. The metamorphosis of chlorine was diminished during rest and work, especially in the latter case.

Therapy. — Kola exercises a preservative action upon the teeth and gums, and promotes appetite and digestion. It favorably modifies the functions of the liver. It is, therefore, adapted to act as a remedy in dyspepsia, whether of gastric or hepatic origin. It relieves the vomiting, vertigo, and depression of seasickness.

For painful dyspepsia Dr. Monin recommends:—

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[1] *Pharmaceutical Record*, Jan. 5, 1891.

℞ Tinct. opii camph. ..... 15| c.cm. or f℥ss.
Tinct. kolæ,
Tinct. vanill. ..... aa 9|25 c.cm. or f3iiss.
Mucilag. acacia .....120| c.cm. or f℥iv.
M. Sig.: Tablespoonful three times a day.

Its combined stomachic and astringent properties render it of service in the treatment of acute and chronic diarrhœa. In its native country it is thought to protect Europeans against affections of the liver, and the natives esteem it as a prophylactic against dysentery. It has been proposed as likely to be of service in cholera. As a heart-stimulant, it may be employed in weakened conditions of that organ, in fever, and in phthisis. Kola is useful in cardiac asystole and in the debility attendant upon convalescence from influenza. It is directly serviceable in disease of the heart as a diuretic. Its favorable influence upon the nervous system suggests its employment in neuralgia. It is stated that kola has a remarkable power of promoting cheerfulness, and may be very serviceably used in hypochondria and melancholia. It is probably of value in overcoming the taste for alcoholic liquors. As a substitute for coca or tea, kola may be given in cases of weak digestion, employing the preparation kolafra, which is used like breakfast-cocoa. Kola has a tendency to cause wakefulness, and for this reason it is advisable to avoid its use in the evening. Dujardin-Beaumetz found kola of advantage in the treatment of diabetes mellitus. The following formulæ are taken from the columns of *Le Journal de Médecine de Paris*:—

℞ Ext. cinchon.,
Ext. kolæ ..... aa 5| Gm. or gr. lxxv.
Ext. rhei ..... 2|50 Gm. or gr. xxxviij.
Ext. nucis vom. ..... |50 Gm. or gr. viiss.
Ferri arsenatis ..... |20 Gm. or gr. iij.
Pulv. kolæ ..... q. s.
M. et div. in pil. no. c.
Sig.: Two pills with each meal.

℞ Vini kolæ,
Vini cinchon.,
Vini gentianæ,
Vini calumbæ .....aa 240| c.cm. or f℥viij.
Liq. potass. arsenit. ..... |60 c.cm. or gtt. x.
Tinct. nucis vom. ..... |30 c.cm. or gtt. v.
M. Sig.: A claretglassful after each meal.

The preparations made from the fresh seeds—the fluid extract, wine, or elixir—are elegant and very valuable restorative remedies.

KOUMISS. — Kumyss, Milk-wine. Originally made in Asia by the Tartars as an intoxicating drink by fermenting mares' milk, koumiss has been introduced into European medicine as a food and as a remedial agent. It can be made for medical use by adding a small piece of compressed yeast to diluted cows' milk containing a small amount of grape-sugar; it should be kept in a cool place, with frequent agitation, and used on the fourth or fifth day. The late Prof. S. W. Gross (*College and Clinical Record*) gave the following directions for preparing koumiss: Dissolve 15.5 Gm. (or ℥ss) of grape-sugar in 120 c.cm. (or f℥iv) of water. Dissolve 1.30 Gm. (or gr. xx) of yeast-cake in 120 c.cm. (or f℥iv) of milk. Pour both into a quart bottle and fill nearly to the top with milk. Cork tightly, fastening the cork with wire.

Put into a cool place and shake two or three times daily for three days. *Keep for use no longer than six days.* A champagne-tap introduced through the cork is necessary. Koumiss contains about 16 per cent. of alcohol, and is a pleasant, acidulous drink.

Physiological Action and Therapy.—The combined action of the carbonic acid and alcohol in koumiss produces an exhilarant impression. It raises the arterial tension and assists in assimilation. It adds tone to the stomach, aids the appetite, excites the action of the kidneys and skin, and favors sleep. Koumiss, by reason of its utility as a nutriment during inflammatory action, is of great service in phthisis, scrofula, chronic bronchitis, and in the treatment of surgical cases. In an irritable stomach it is a most beneficial remedy in its sedative and nutritive effect. In the nausea and vomiting of pregnancy, owing to the action just referred to, koumiss very often acts in a most happy manner, the nutrition and bodily vigor of patients being increased by the continued use of koumiss during this period. At the time of confinement, when nausea and vomiting supervene, followed by exhaustion, koumiss will often assist in restoring the flagging powers. During the state of lactation koumiss will be very grateful, will assist the nutrition of the system, and will be productive of better and more nourishing milk. Thominski has observed a decidedly beneficial effect from the use of koumiss in two cases of irregular menstruation and in one case of abundant nasal hæmorrhage.

In convalescence from acute diseases, in diarrhœa and dysentery, koumiss will be serviceable to feeble digestion, and will aid in assimilation. In cholera infantum, gastro-intestinal diseases of childhood, and in fevers koumiss is a most agreeable form of food. Koumiss serves as an excellent vehicle for the administration of lactic acid to children suffering with diarrhœa. D. H. Davies suggests the preparation of euonymized koumiss as suitable to cases of hepatic derangement attended by nausea and vomiting. It can be made by adding 11 c.cm. (or f℥iij) of fluid extract of euonymus to every pint of the diluted milk from which koumiss is obtained. In the same manner cocaine hydrochlorate may be incorporated with koumiss for the treatment of cancer of the stomach. It is also an admirable remedy and food in acute and chronic alcoholism, in albuminuria, diabetes, gastralgia; gastric ulcer, and in the various forms of cancer and dyspepsia. Koumiss is especially useful in cachexia of kidney disease (120 c.cm., or f℥iv, four or five times a day).

The amount of koumiss administered to each case should vary according to the disease. In some instances from 30 to 120 c.cm. (or f℥i-iv) can be given every one to three hours; in others as much as a good-sized glassful or two can be taken frequently during the day and night. The writer has administered as much as three or four quarts of koumiss a day in diseases attended with much exhaustion, and often with decidedly good effect.

KRAMERIA (U. S. P.).—**Krameria (Rhatany).**

KRAMERIÆ RADIX (B. P.).—**Krameria-root.**

Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Preparations.

Syrupus Krameriæ (U. S. P.).—Syrup of Krameria (fluid extract, 45; syrup, 55). Dose, 4 to 15 c.cm. (or f℥i-iv).

Fluidextractum Krameriæ (U. S. P.).—Fluid Extract of Krameria. Dose, 0.06 to 1.20 c.cm. (or *m*i-xx).

Extractum Krameriæ (U. S. P., B. P.).—Extract of Krameria. Dose, 0.065 to 0.65 Gm. (or gr. i-x).

Tinctura Krameriæ (U. S. P., B. P.).—Tincture of Krameria (20 per cent.). Dose, 4 to 15 c.cm. (or f3i-iv). B. P., 2 to 4 c.cm. (or f3ss-j).

Trochisci Krameriæ (U. S. P., B. P.).—Troches of Krameria (each, 0.065 Gm., or gr. j, of extract). Dose, 1 or more.

Trochiscus Krameriæ et Cocainæ (B. P.).—Krameria and Cocaine Lozenge (extract of krameria, 0.065 Gm., or gr. j; cocaine hydrochloride, 0.00324 Gm., or gr. $^1/_{20}$).

Liquor Krameriæ Concentratus (B. P.).—Concentrated Solution of Krameria. Dose, 2 to 4 c.cm. (or f3ss-j).

Infusum Krameriæ (B. P.).—Infusion of Krameria (50 Gm. to 1000 c.cm., boiling, distilled water). Dose, 15 to 30 c.cm. (or f℥ss-j).

Pharmacology.—Krameria is "the dried root of Krameria triandra, of K. ixina, or K. argentea (Krameriaceæ or Leguminosæ)," (U. S. P.); "the dried root of (1) Para Rhatany, a species of Krameria, attributed to Krameria argentea, or of (2) Peruvian Rhatany, Krameria triandra" (B. P.), growing in South America. It contains about 20 per cent. of **Krameriotannic acid,** which is the active constituent.

Physiological Action.—Krameria is a powerful astringent.

Therapy.—In Peru it is largely used as a remedy for bowel disorders, diarrhœa, dysentery, etc. The infusion is a satisfactory gargle for relaxed throat, and the lozenge is also used for this purpose. The tincture of krameria may be combined with chalk mixture in the treatment of summer diarrhœa. Krameria is employed as a systemic remedy in epistaxis, hæmatemesis, hæmaturia, and other forms of hæmorrhage. It is of service, both locally and internally, in hæmorrhoids and leucorrhœa, and the tincture or the fluid extract is used, diluted and in combination with other astringents, as an injection, in gonorrhœa. A mixture of the decoction and the tincture was recommended by Trousseau as an injection for the treatment of fissure of the anus. The powdered extract enters into the composition of many tooth-powders.

LACTUCARIUM (U. S. P.).—**Lactucarium, Lettuce-opium.**
Dose, 0.65 to 1.30 Gm. (or gr. x-xx).

Preparations.

Tinctura Lactucarii (U. S. P.).—Tincture of Lactucarium. Dose, 0.60 to 4 c.cm. (or *m*x-f3j).

Syrupus Lactucarii (U. S. P.).—Syrup of Lactucarium (10 per cent. of tincture). Dose, 4 to 15 c.cm. (or f3i-f℥ss).

Pharmacology.—"The concrete milk-juice of Lactuca virosa (Compositæ)," a wild variety of lettuce growing in Europe, but also found in garden lettuce, Lactuca sativa. The only important constituent is the mixed substance, **Lactucarium,** obtained by evaporation of the milky juice. It is in flattened pieces or cakes, of reddish-brown color, internally white or waxy-looking, of heavy, opium-like odor, and a bitter taste. French lactucarium, being simply a blackish-brown extract of lettuce, is inferior to that of the pharmacopœia of the United States, which is made from the expressed juice. The French syrup of lactucarium (Aubergier), however, is considered an active as well as an elegant preparation. Lactucarium consists of **Lactucerin,** or **Lactucon**; and the bitter principles, **Lactucin, Lactucopicrin,** and

Lactucic acid. Mr. T. S. Dymond has stated that a small proportion of hyoscyamine is contained in lettuce, but this has been disproved. About 50 per cent. (consisting chiefly of lactucerin) of lactucarium is insoluble in water. There is no starch present.

The syrup is pleasant to the taste; a glycerite may be made of the same strength as the syrup, by using glycerin instead of simple syrup.

Physiological Action.—It is a feeble narcotic, and owes its reputation largely to the observation that eating lettuce causes drowsiness. Its preparations vary greatly in activity, but are not toxic, and are therefore much safer for children than those of opium. Some action upon the kidneys is also observed, and it allays spasmodic cough.

Therapy.—The syrup is used in cough-mixtures for children. To allay nervous irritability, and as a substitute for the soothing syrups containing morphine, it has decided value. On account of its insoluble constituents, lactucarium should be given in substance, or in the form of the tincture, or the fluid extract of the National Formulary. The fluid extract may be used in elderly persons, or where there is an idiosyncrasy against opium, to fulfill the same ends.

Lactucin has been employed as a sedative and hypnotic in the dose of 0.065 to 0.13 Gm. (or gr. i-ij).

LAMINARIA.—Laminaria, Sea-tangle. The cylindrical base of the thallus of Laminaria Cloustoni, and of Laminaria digitata (Algæ), when dried, are cut into appropriate lengths and shape, and their surface made smooth, to be used as substitutes for sponge tents in dilating the cervix uteri, owing to their property, when moistened, of swelling up to several times their original size.

LAPPA (U. S. P.).—**Burdock.**
Dose, 15.5 Gm. (or ʒiv) in recent infusion.

Preparation.

Fluidextractum Lappæ (U. S. P.).—Fluid Extract of Burdock. Dose, 2 to 4 c.cm. (or *m*xxx-fʒj).

Pharmacology.—"The dried root of Arctium lappa, or of other species of Arctium (Compositæ), collected from plants of the first year's growth." It contains a bitter principle, volatile oil, resin, mucilage, sugar, and a little tannin. There is no starch in burdock-root, but in its place inulin is found.

Physiological Action and Therapy.—Burdock is diaphoretic, diuretic, and laxative, without causing irritation. The fluid extract is used externally for swellings, hæmorrhoids, ulcers, etc., and internally for rheumatism, syphilis, and chronic skin diseases.

Acording to Squibb, the tincture[1] is a useful tonic and is held to be curative in psoriasis.

The root is used for similar purposes to those of sarsaparilla in syphilitic, gouty, and rheumatic affections, and in certain chronic skin diseases, such as psoriasis. A fluid extract of the seeds (dose, 1 to 4 c.cm., or *m*xv-fʒj) and a tincture of the seeds (1 to 8) are employed; also an infusion or decoction of the seeds.

[1] "Ephemeris," vol. i, p. 116.

The fresh leaves have been used as an application to bruises and eruptive disorders.

LARGIN is a name given to silver-protalbin, by its originator, Lilienfeld, of Vienna. It is a gray powder of low specific gravity containing 11 $^{1}/_{10}$ per cent. of silver. It is soluble in about 10 parts of water, making a reddish-brown-tinged solution; such solutions should be made with hot water. Pezzoli and Neisser claim a special penetration power as an antigonorrhœic remedy, with destruction of the cocci in their nests, with avoidance of irritation of the mucosa. Pezzoli extols largin as the best of the silver compounds. Prolonged injections of $^{1}/_{4}$ to 1 $^{1}/_{2}$ per cent. of 10 c.cm. (or *m*clx) are used three times daily, retaining the quantity in the urethra from ten to fifteen minutes, in treating specific urethritis. Furst has used largin internally, 0.50 Gm. (or gr. viij) in pill, as a substitute for silver nitrate, in gastric ulcer and hæmorrhage.

LAUROCERASI FOLIA (B. P.).—**Cherry-laurel Leaves.**

Preparation.

Aqua Laurocerasi (B. P.).—Cherry-laurel Water (320 Gm., or 3lxxxiiss, in 1000 c.cm., or Oiif℥ij). Dose, 2 to 7.5 c.cm. (or f3ss-ij).

Pharmacology. — "The fresh leaves of Prunus laurocerasus" (B. P.), which belongs to the Rosaceæ, contain **Laurocerasin,** a compound of amygdalin and **amygdalic acid,** and also **Emulsin,** which, when in the presence of water, form a volatile oil (benzaldehyde) and hydrocyanic acid, to which it owes its medicinal qualities. Cherry-laurel water is distilled from the fresh leaves, bruised and macerated in water; it contains the volatile oil and hydrocyanic acid, but is of such uncertain strength as to almost preclude its use in medicine.

Therapy.—It is used in Europe (very rarely in this country except by foreign physicians) for the same purposes as bitter-almond water, and chiefly as a vehicle for anodyne and antispasmodic remedies. A cherry-laurel ointment, consisting of 1 part of essence of laurel-water to 8 parts of lard, is used in Italy in painful affections, as neuralgia, herpes zoster, chronic rheumatism, and carcinoma. It would make an agreeable dressing for burns.

LAURUS.—Laurel, Bay, or **Bay-laurel.** The leaves and berries (Lauri folia and Lauri baccæ) of Laurus nobilis (Lauraceæ), a tree of Southern Europe, contain volatile oil, **Laurin,** or laurel-camphor; a liquid fixed oil; a solid fixed oil known as **Laurostearin,** and starch. The volatile oil of laurel-berries, consisting of a camphene and eugenic acid, is occasionally employed externally in rheumatism. By boiling the fresh fruit in water and using pressure the expressed oil of laurel is obtained, which is used in the form of ointment, as an anodyne. Leaves, berries, and oil are stimulant and narcotic. A laurel ointment is official in the French Codex. It is composed of 1 part each of fresh laurel-leaves and laurel-berries, with 2 parts of lard. This preparation is applicable to erythema, dermatitis, erysipelas, acute eczema, and superficial burns. The leaves are used in cooking for flavoring (bay-leaves, bay-laurel leaves); they should not be confounded with the leaves of **Myrcia acris,** from which the volatile oil of bay is distilled, that is used as a

perfume (and enters into spiritus myrciæ, or bay-rum), or **Myricæ Cerifera Cortex**,—bay-berry bark.

LAVANDULA.—Lavender, Lavender-flowers.

Preparations.

Oleum Lavandulæ Florum (U. S. P.).—Oil of Lavender-flowers. Dose, 0.18 to 0.30 c.cm. (or *m*iii-v).

Spiritus Lavandulæ (U. S. P., B. P.).—Spirit of Lavender (oil of lavender-flowers, 50; deodorized alcohol, 950 c.cm.; B. P., oil of lavender, 30 c.cm. (or f℥j); alcohol, 90 per cent., 270 c.cm. (or f℥ix). Dose, 2 to 4 c.cm. (or f3ss-j). B. P., 0.30 to 1.20 c.cm. (or *m*v-xx).

Tinctura Lavandulæ Composita (U. S. P., B. P.).—Compound Tincture (formerly Spirit) of Lavender (U. S. P. contains oil of lavender, 8; oil of rosemary, 2; saigon cinnamon, 20; cloves, 5; nutmeg, 10; red saunders, 10; in alcohol, water, and diluted alcohol to make 1000 c.cm.). Dose, 2 to 4 c.cm. (or f3ss-j).

Oleum Lavandulæ (B. P.).—Oil of Lavender. Dose, 0.03 to 0.18 c.cm. (or *m*ss-iij).

Pharmacology.—The carefuly dried flowers of Lavandula angustifolia (Labiatæ), much cultivated for their perfume, contain volatile oil, some resin, and tannin. The oil of lavender, distilled from the whole herb or flowering tops, is coarser than that distilled from the flowers alone; of the latter there are several varieties, differing in value and fineness. The English oil, distilled from cultivated flowers, (known as oil of garden lavender) is to be distinguished from the ordinary commercial oil, which is much lower in price, and is made from wild flowers (also known as French oil of lavender). An inferior, greenish, turpentine-like oil, distilled from Lavandula spica, is known as oil of spike-lavender. The oil of lavender has the property of checking decomposition. The compound tincture is an elegant preparation of aromatics and stimulants.

Lavender is carminative and stimulant. It is useful in flatulence, nervous dyspepsia, gastralgia, colalgia, hysteria, and syncope. Lavender is said to be possessed of considerable hypnotic power. It is used in perfumery, and enters into the unofficial spiritus odoratus and vinum aromaticum; also liquor potassii arsenitis (U. S. P.), liquor arsenicalis (B. P.), and spiritus ammoniæ aromaticus (U. S. P.).

LEDUM.—Ledum, Wild Rosemary. The small twigs, tops with undeveloped flowers and leaves of Ledum palustre (Ericaceæ), but **without** the fruit even partly formed, contain volatile oil, **Valerianic Acid, Ericolein, Leditannic Acid,** resin, etc., and are used in infusion, as marsh-tea. Ledum is said to be somewhat narcotic, astringent, and tonic; it is used externally to destroy parasites, and internally in diarrhœa and dysentery, gout, rheumatism, and chronic skin diseases. Dr. R. Hilbert, of Sensburg, reports that an infusion of the leaves of this plant (6 to 12 Gm. to 240 c.cm., or 3iss-iii to f℥viij of water) acts as a good expectorant in bronchitis. It rapidly relieves the pain and fever, especially in juvenile patients. In chronic bronchitis it diminishes cough and facilitates expectoration. This writer regards ledum as especially valuable in bronchitis with emphysema occurring in aged persons, as it renders the secretion less viscid, stimulates the circulation, and lessens dyspnœa.

LEONURUS.—Leonurus, Motherwort. The flowering tops and leaves of Leonurus cardiaca (Labiatæ) contain a bitter principle, some volatile oil,

etc. It is used in recent infusion, and, as a fluid extract, with dilute alcohol, as a menstruum to promote the menstrual discharge, and in suppression of the lochia. It is also deemed useful in hysterical pains.

LEPTANDRA (U. S. P.).—**Leptandra (Culver's Root).**

Dose, 1.30 Gm. (or gr. xx).

Preparations.

Extractum Leptandræ (U. S. P.).—Extract of Leptandra. Dose, 0.20 to 0.65 Gm. (or gr. iii-x).

Fluidextractum Leptandræ (U. S. P.).—Fluid Extract of Leptandra. Dose, 2 to 4 c.cm. (or f3ss-j).

Pharmacology.—"The dried rhizome and roots of Veronica virginica (Scrophulariaceæ)" contain a bitter principle, **Leptandrin**; also saponin, tannin, resin, starch, etc. What is ordinarily designated leptandrin is merely an impure resin or alcoholic extract. Leptandra is common in woods from Vermont to Wisconsin and southward.

Physiological Action.—Leptandra-root, or Culver's physic, is a cholagogic cathartic. It should be dried, for in its recent condition it acts too violently. The extract is an eligible form in which to use the drug, which, in small doses, is tonic and laxative. Leptandrin in its common form is employed as a cathartic in doses of 0.065 to 0.13 Gm. (or gr. i-ij).

Therapy.—In indigestion, with deficiency of secretions and constipation, leptandra has been found useful, and may be combined with podophyllum, which it resembles in its effects, or with aromatics. When the stools are clay colored and show a deficiency of bile, this agent may be used to bring about bilious discharges, even when there is diarrhœa.

LIMON.—Lemon.

Preparations.

Limonis Succus (U. S. P.).—Lemon-juice. The freshly-expressed juice of the ripe fruit of Citrus limonum (Aurantiaceæ).

Limonis Cortex (U. S. P., B. P.).—Lemon-peel. "The recently-separated outer rind of the ripe fruit of Citrus limonum (Aurantiaceæ)" (U. S. P.); "the fresh outer part of the pericarp of the fruit of Citrus medica" (B. P.).

Preparations from the Cortex, or Rind.

Oleum Limonis (U. S. P., B. P.).—Oil of Lemon. Dose, 0.03 to 0.18 c.cm. (or *m*ss-iij); also used for flavoring.

Tinctura Limonis Corticis (U. S. P.).

Tinctura Limonis (B. P.).—Tincture of Lemon. Dose, 2 to 4 c.cm. (or f3ss-j).

Syrupus Limonis (B. P.).—Syrup of Lemon. Dose, 2 to 4 c.cm. (or f3ss-j).

Preparations from the Juice.

Syrupus Acidi Citrici (U. S. P.).—Syrup of Citric Acid. As a vehicle.

Acidum Citricum (U. S. P., B. P.).—Citric Acid. Dose, 0.32 to 1.30 Gm. (or gr. v-xxx).

Pharmacology.—Lemons, owing to their pleasant flavor and agreeable acidity, are very useful in the sick-room. The rind is glandulous, and by expression yields an oil of great fragrancy, much superior to that obtained by distillation. When fresh, the rind of lemon, besides the oil above mentioned, contains a bitter, crystalline glucoside, **Hesperidin.** Each lemon yields from 7.5 to 30 c.cm. (or f3ii-viij) of acidulous juice, containing citric acid (7 to 9 per cent.), besides phosphoric and malic acids, in combination partly with potassa and other bases. A solution of citric acid in water (2.30 Gm. to 30 c.cm., or gr. xxxiv to f3j) corresponds in acidity with fresh lemon-

juice, but not therapeutically on account of absence of other constituents. Fifteen c.cm. (or f℥ss) of lemon-juice should neutralize 25 grains of potassium bicarbonate, 20 of sodium bicarbonate, or 14 of ammonium carbonate. Lime-juice, obtained from a smaller fruit of the same genus (Citrus acris), closely resembles fresh lemon-juice, but acquires a peculiar, slightly musty taste from the wood in which it is imported. When preserved, boiled in syrup and dried (candied), lemon-peel is useful in flavoring, for cooking, etc.

Therapy.—Lemon-juice is applied to the surface of the skin to remove freckles or ephelides, moth-spots, sunburn, pruritus, and ink-stains. Used internally, lemon- or lime- juice is antiscorbutic, probably owing to the presence of phosphoric acid or potash salts, as citric acid does not possess this property. It is now so constant a companion of voyagers by sea that scurvy is rarely seen, except where the regular ration of lemon- or lime-juice has been neglected. It is also curative in scurvy, and in various scorbutic manifestations upon the skin, or in the form of muscular pains. In some cases of chronic rheumatism the administration of several ounces of lemon-juice daily affords marked relief. Lemon-juice has been likewise used in acute rheumatism with, at times, apparent good results. Lemonade, made by diluting lemon-juice with water and adding sugar, is a useful drink during convalescence; it increases the urinary water and reduces the acidity of the urine. Hot lemonade is useful as a diaphoretic in recent colds; its effects are increased by the addition of a little whisky or gin. Neutral mixture, made by neutralizing fresh lemon-juice by the addition of crystals of potassium bicarbonate, is useful as a refrigerant and to satisfy thirst in fevers.

In typhoid fever the late Dujardin-Beaumetz advised the free use of a vinous lemonade, made according to the formula:—

℞ Syrup. acid. citrici	60	c.cm. or f℥ij.
Vini rubri	240	c.cm. or f℥viij.
Olei limonis	1	c.cm. or *m*xv.
Aquæ q. s. ad	1000	c.cm. or Oiif℥ij.—M.

Atheromatous changes in the arteries are retarded by the persistent use of lemon-juice, which is also useful in obesity. In Italy, an infusion of the lemon, the rind being incised to allow the juice to escape, is administered in ague and other malarial attacks attended by fever. Lemon-juice is regarded as of material assistance to other remedies in the treatment of torpidity of the liver and catarrhal jaundice.

LINDERÆ CORTEX.—Lindera-bark, Spice-bush Bark. The Benzoin odoriferum (Lauraceæ), Lindera benzoin, or spice-bush, is one of our common forest shrubs, belonging to the same natural order as the sassafras, the cinnamon, and the camphor-tree. The bark and fruit contain a volatile oil, resin, and the common vegetable principles. The bark has a pleasant, spicy taste, due to the oil.

Physiological Action.—It is aromatic, stimulant, and tonic, and a recent, hot, weak infusion is diaphoretic.

Therapy.—In some disorders of digestion the carminative and tonic effects are available; the infusion is used in chills and to abort a cold. A decoction of the inner bark made into an ointment with cold cream is recommended by Hyde as a valuable remedy in rhus poisoning.

LINUM (U. S. P., B. P.).—**Linseed (Flaxseed).**

Preparations.

Oleum Lini (U. S. P., B. P.).—Linseed-oil.
Linum Contusum (B. P.).—Crushed Linseed.

Pharmacology and Therapy.—"The ripe seed (dried ripe, B. P.), of Linum usitatissimum (Linaceæ)," commonly called flaxseed, contains mucilage, linolein, and gum (15 per cent.). The latter forms mucilage with boiling water, which is not precipitated by tannin.

A nitrogenous glucoside, termed **linamarin**, has been obtained from the young plant by MM. Jorissen and Hairs. Linamarin differs in several physical and chemical properties from amygdalin, and occurs as colorless and odorless needles which have a very cooling and bitter taste. It is soluble in water and alcohol, but almost insoluble in ether. It is not present in the seeds, which contain about 25 per cent. of albumin, and no starch. The investing coat of the seeds yields a very viscous mucilaginous substance to boiling water. Linum is demulcent and emollient. A hot infusion (15.5 Gm. to 500 c.cm., or ℥ss-Oif℥j), flavored with licorice-root or lemon-peel, is used in bronchial inflammations as a diaphoretic and expectorant; also in cystitis, strangury, and hæmaturia. A plain infusion is an excellent enema for use in inflammation of the rectum, fissure, hæmorrhoids, etc. Flaxseed-tea is used as a demulcent drink in gastritis.

Ground flaxseed mixed with boiling water forms flaxseed poultice, which is spread at least half an inch in thickness upon muslin or flannel, and applied as hot as possible in order to relieve pain and congestion in peritonitis, and in pneumonia, pleurisy, etc., as jacket poultices, renewed every two or three hours. They should be covered with oiled silk to retain heat and moisture, and, if desired to increase the counter-irritant effect, a little dry mustard or a few drops of turpentine may be sprinkled over the surface. They usually afford great relief to the patient. Laudanum, or lead-water and laudanum, is often used with a flaxseed poultice in inflammatory and painful affections. Flaxseed poultices are also applied to boils and abscesses to soften the skin or to hasten ripening. They are also applied occasionally to ulcers and wounds to encourage granulations and bring about healthy action.

The long-continued application of poultices is likely to bring out an eruption of small boils upon the skin, the result of hyperæmia and irritation. Poultices are often useful for temporary purposes, but too long applied are mischievous. The integument and the vessels subjected to their influence become relaxed, suppuration is prolonged, granulations rendered unhealthy, and the repair of ulcers or wounds retarded.

Oil of flaxseed is an old application to burns to exclude the air; combined with lime-water, it forms Carron oil, which was formerly used largely for this purpose, having been originally used at an iron works of that name in Scotland, where the workmen were frequently burned. It is dirty and soon smells badly, and is now abandoned in favor of petrolatum and kaolin. Whole flaxseed, in 15.5 Gm. (or ℥ss) doses, have been ordered in habitual constipation as a laxative. Flaxseed candy is popularly used for pharyngitis, as trochees.

LIPPIA MEXICANA.—Lippia Mexicana (Verbenaceæ), a creeping, evergreen shrub, with very long roots and numerous branches, grows abun-

dantly in southern Mexico. Its medicinal virtues reside in the leaves and stalks, especially in the leaves, which possess an agreeable, sweetish, and aromatic taste. The plant contains a small proportion of tannic acid, an ethereal oil, and a volatile camphor termed **Lippiol.** A fluid extract and a tincture have been prepared, the dose of the former being from 0.30 to 2 c.cm. (or *m*v-xxx), and of the latter from 2 to 4 c.cm. (or f3ss-j).

Physiological Action.—Lippia causes a sensation of warmth in the stomach, and in large doses may give rise to vomiting. This is succeeded by free perspiration and sleepiness.

Therapy.—The drug is endowed with valuable expectorant properties. It allays irritation of the bronchial mucous membrane and promotes healthy secretion. Its effects are rapidly manifested. Lippia is useful in both acute and chronic bronchitis. In the former it allays the cough, and in the latter it liquefies the viscid secretion and facilitates expectoration. It is of service in the cough of phthisis, has an excellent effect in irritative cough, and in whooping-cough mitigates the paroxysms, though it is not able to shorten the course of the disease. It has, in some instances, proved useful in spasmodic asthma.

LIQUIDAMBAR.—Sweet Gum.—The Liquidambar styraciflua (Hamamelaceæ) of North and Central America supplies a brownish-yellow balsam, containing styrol (3 $^1/_2$ per cent.), cinnamic acid (5 per cent.), styracin, and resin. It is identical with storax, according to Professor Maisch. The syrup of the bark of the root, made like the syrup of wild cherry, is a remedy used for diarrhœa and dysentery in the Southern States.

LIQUOR FORMALDEHYDI (U. S. P.).—**Solution of Formaldehyde.**

Pharmacology.—Formic aldehyd, or formaldehyde, is a colorless gaseous body (CH_2O), with a pungent, irritating odor, and very decided antiseptic and bactericidal properties. It was discovered by Hofmann in 1868. It may be produced by exposing a heated platinum spiral to the vapor of methyl alcohol; it is therefore an oxidation product. Formaldehyde gas is obtained conveniently by heating an aqueous solution. The official solution must contain not less than 37 per cent. by weight of absolute formaldehyde (H.COH=29.79). It should be kept in well-stoppered bottles in a cool place, protected from the light. Formaldehyde solution is a colorless fluid of pungent odor and mixes with water in all proportions. This, when boiled, gives off the vapor of formaldehyde, and, less rapidly, at ordinary temperatures. *Paraform* is the commercial title of a preparation in the form of pastilles. This substance, which is a polymerized form of formaldehyde, may be used to generate the gas by means of a suitable lamp.

Physiological Action.—Formaldehyde is an efficient bactericide. The vapor readily condenses upon objects in an apartment where the fluid is exposed. It is, consequently, excellently adapted to the disinfection of surgical and dental instruments, sick-rooms, hospital-wards, furniture, clothing, books, discharges, drains, etc. It destroys foul odors, and penetrates fabrics without injuring them or destroying their color. Its inhibitory influence upon the growth of bacteria enables the investigator to fix, at any stage, those organisms for the purpose of study or demonstration. This property has been likewise applied to the diagnosis between the typhoid bacillus and the bacterium coli commune, which organisms exhibit a marked difference of susceptibility to the action of formaldehyde.

Formaldehyde-gas is only slightly toxic. Flies and insects are not affected by it; but higher animals suffer from the very irritating character of the vapor to the eyes and nose. Undiluted formalin (40 per cent.), when applied to the animal skin, occasions necrosis without suppuration. An injection equivalent to about 0.37 c.cm. (or *m*vj) to the pound of body-weight was rapidly fatal to guinea-pigs, the animal becoming comatose and dying without convulsions. It reduces temperature from 2° to 4° F. It is eliminated in the urine within twenty-four hours. Attention has been directed to the use by dairymen of formaldehyde, in order to prevent souring of milk. The Editor of the *Cincinnati Lancet-Clinic* has recently called attention to this form of adulteration, and attributes many cases of ice-cream poisoning to this cause. He asserts that "the yearly mortality among children in New York is ascribable more to formaldehyde milk than any other agency." Glover reports a severe urticaria following the application to the scalp of a hair wash containing formaldehyde.

Treatment of Poisoning.—Andre reported a case of poisoning with one drachm of a 40-per-cent. solution, which was treated successfully with solution of acetate of ammonia. The action of ammonia on formaldehyde is to form hexamethylenamine (or urotropin), which is comparatively innocuous. Aromatic spirits, or plain water of ammonia, may also be used.

Therapy.—Formalin has been employed in general surgery by de Buck and Vanderlinden, of Ghent. A $^1/_2$-per-cent. solution was used for washing hands, cleansing the seat of operation, and for the disinfection of wounds, cavities, and sinuses. These writers have obtained excellent results from its use as a wash and dressing after major operations.

The peculiar necrotic effect of formalin may render it valuable in the destruction of benign or malignant growths of the skin. Mitchell treated sarcoma successfully with compresses of 20-per-cent. solution, covered by gutta percha tissue, renewed once daily. A $^1/_2$- to 1-per-cent. solution is recommended as a serviceable application to sweating hands and feet. It has been demonstrated that this agent would prove a serviceable application in psoriasis and lupus. On account of the ready diffusion of its vapors, M. Potterin asserts that formalin is an excellent antiseptic application to the skin, suitable to the treatment of diseased conditions of the hair-roots and follicles. Absorbent cotton moistened in a 2-per-cent. solution of formalin and covered with an oil-skin bandage is usually well tolerated. A 5- to 10-per-cent. solution has been used successfully in favus. Formaldehyde in gaseous form is now generally used as a disinfectant. For disinfecting and sterilizing purposes, special forms of apparatus can be obtained, which are convenient and efficient, at a moderate cost. They are used in the United States army and in the Marine-Hospital service, as well as by local health-boards.

In the practice of dentistry, formalin may be used for the purpose of killing the nerves of carious teeth. The inhalation of a very weak spray of formalin may prove beneficial in chronic laryngitis, bronchitis, etc., but the nasal mucosa is too sensitive to permit its use in any strength which would be likely to be serviceable, unless there is a preliminary spraying with cocaine.

Formalin has been used in ophthalmology by Dr. M. Valude. A solution of 1 to 2000 causes slight smarting when first applied to the eye, but the sensation soon vanishes. With a solution of this strength Valude has

successfully treated chronic conjunctivitis and ophthalmia neonatorum, and recommends its addition to collyria in order to effect sterilization.

Formaldehyde has lately been used by Hahn[1] in chronic joint affections of tubercular origin, and also in tubercular abscesses and empyema. The abscess-cavity is emptied by means of the aspirating needle and thoroughly cleansed from the tubercular pus by repeated injections with boric-acid solution. Then a 1-per-cent. solution of formaldehyde in glycerin is thrown into the cavity, the amount used varying from one-third to one-half of the quantity of pus withdrawn. The results have been markedly successful.

In laryngeal tuberculosis and also in pulmonary tuberculosis the inhalation of a spray, or simply of the vapor of hot water containing a few drops of the solution, has been found very useful by Solis-Cohen. T. J. Gallagher, of Denver, after cleansing the laryngeal ulcer with hydrogen dioxide and applying cocaine, uses a local application of $^1/_2$ to 10 per cent., which shrinks vegetations and destroys micro-organisms. In whooping-cough and diphtheria sprays of 1 per cent., for twenty minutes, thrice daily are very efficient.

The hypodermic or intravenous injections of weak solutions of formalin have been employed in phthisis pulmonalis, and especially in puerperal septicæmia. This method is not recommended, because, as shown by W. H. Park, of New York Health Department, the formalin actually reduces the resistance of the white blood-cells and tissues, to the infection.

LITHIUM.—The metal **Lithium** (Li).

Salts.

Lithii Benzoas (U. S. P.).—Lithium Benzoate. Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Lithii Bromidum (U. S. P.).—Lithium Bromide. Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Lithii Salicylas (U. S. P.).—Lithium Salicylate. Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Lithii Carbonas (U. S. P., B. P.).—Lithium Carbonate. Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Lithii Citras (U. S. P., B. P.).—Lithium Citrate. Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Lithii Citras Effervescens (U. S. P., B. P.).—Effervescent Lithium Citrate. Dose, 4 to 8 Gm. (or 3i-ij).

Pharmacology.—Lithium is an alkali metal existing in nature as a silicate, in the minerals, **Lipidolite, Petalite,** etc., or as the phosphate, in **Triphyline** and **Amblygonite.** It decomposes water at ordinary temperatures, but without melting like sodium, and is less easily oxidized than either sodium or potassium. The metal (which is not official) resembles tin. It was first obtained by Bunsen by electrolysis of the chloride. Its salts are soluble in water, but the carbonate and phosphate only slightly so.

Physiological Action.—Lithium urate is freely soluble, and therefore when lithium, in combination with the vegetable acids, is administered, these salts are decomposed in the system and the lithium, combining with uric acid, renders it soluble, and thus facilitates its expulsion from the body. These salts are also diuretic, and their administration, therefore, produces an increase in the urinary secretion. Lithium carbonate promotes the assimila-

[1] *Centralblatt für Chirurgie*, No. 24, 1899.

tion and metabolism of nitrogenous material and increases the elimination of urea. Some mineral waters largely owe their medicinal effects to the small proportion of these salts which they contain, being rendered more effective by natural combination with other salts. According to the experiments of M. Binet, toxic doses of lithium occasion arrest of the heart in diastole.

Therapy.—In the uric-acid diathesis the several salts of lithium are used with great advantage, even where chalky deposits exist. It has been asserted that their prolonged use will dissolve uric-acid calculi in the urinary passages or bladder. Where there is vesical catarrh and alkaline urine, the benzoate is the best salt to use, since it renders the urine more acid; where the urine is already too acid the other official salts are preferable. In gouty subjects, especially those suffering with indigestion, lithium renders good service, and can be given in the form of an effervescent salt or in Vichy water. In gravel, lithium affords prompt relief. It may be aided by hexamethyenamine. Dr. Duché states that the local action of lithium is beneficial to gouty joints and that gouty conjunctivitis is relieved by frequently washing the eyes with a 1 to 500 solution of lithium carbonate.

The salts of lithium have likewise been advantageously employed in chronic articular and muscular rheumatism. In rheumatoid arthritis they sometimes seem to delay the progress of the malady.

M. Vulpian has found lithium salicylate of service in relieving the pain which, after acute rheumatism, often lingers in the joints when the swelling has disappeared. He believes it is especially beneficial in fibrous rheumatism. In progressive subacute rheumatism he has seen it produce great improvement. In the chronic articular form of the disease this salt has a marked effect upon the joints.

In gout, subacute and chronic rheumatism, as well as in irritable bladder from excess of acid and in uric-acid calculi, lithium may be given thus:

℞ Lithii citratis ..... 6| Gm. or 3iss.
Liquor ammonii acetatis,
Syrupi limonis ..... aa 60| c.cm. or f℥ij.

M. Sig.: Two teaspoonfuls in water every two or three hours for rheumatism and gout.

℞ Lithii iodidi ..... 4| Gm. or 3j.
Syrup. sarsaparillæ comp. .....150| c.cm. or f℥v.

M. Sig.: A half to a tablespoonful three or four times a day for syphilis.

℞ Lithii salicylatis,
Quininæ sulphatis ..... aa 2|60 Gm. or gr. xl.

M. et ft. capsulæ no. xij.
Sig.: A capsule or two every two or three hours for rheumatism and gout.

℞ Lithii bromidi ..... 10| Gm. or 3iiss.
Tinct. cardamom. comp. ..... 30| c.cm. or f℥j.
Glycerini ..... 90| c.cm. or f℥iij.

M. Sig.: Two teaspoonfuls in water every hour or two hours for rheumatism and gout.

℞ Lithii benzoat. ..... 8| Gm. or 3ij.
Tinct. belladonnæ folior. ..... 4|75 c.cm. or *m*lxxij.
Fluidextracti tritici .... 90| c.cm. or f℥iij.

M. Sig.: A teaspoonful every two or three hours for irritable bladder, depending on excess of acid, and in uric-acid calculi.

In pruriginous eczema, caused by gout, a pill composed as follows may be given with advantage:—

℞ Sodii benzoat.,
Lithii benzoat.,
Ext. gentian. ..... aa .065 Gm. or gr. j.
Glycerin. ..... q. s.
M. Sig.: One pill three or four times a day.

A combination of lithium carbonate with sodium bicarbonate is praised by Dr. C. Lange as an excellent application in severe general paræsthesia.

In glycosuria, the combination of arsenic with a lithia-water has been vaunted as curative. The late Dujardin-Beaumetz suggested that the addition of strontium lactate to a lithia-water bids fair to prove of advantage in the treatment of diabetes mellitus. Lithium bromide has been found beneficial in epilepsy by Weir Mitchell, who states that it will in some cases succeed after failure of potassium or sodium bromide. The same writer regards its hypnotic power as superior to that of the potassium bromide. The lithium should always be administered in a large excess of water, and distilled water is better for this purpose on account of its diuretic properties. The artificial lithia-water containing a definite solution of lithium in distilled water is more reliable than many of the commercial, natural lithia-waters. Lithium iodide contains a large proportion of iodine, and is a good method of administering this remedy, the only objection being its high cost. Woodbury[1] recommends the administration of a solution of lithium iodide by electricity, through the cataphoric action of the galvanic current in tubercular syphilides.

LITMUS.—A blue pigment from Rocella tinctoria (Lichenes), imparting its blue coloring-matter, **Orcein,** to water and alcohol. Paper stained with a solution changes its color to red in the presence of an acid; the blue color is restored by plunging the paper in an alkaline solution. Hence we have blue and red test-papers for acids and for alkalies.

LOBELIA (U. S. P., B. P.).—**Lobelia.**

Dose, 0.50 to 1.30 Gm. (or gr. viii-xx), as an emetic.

Preparations.

Tinctura Lobeliæ (U. S. P.).—Tincture of Lobelia (10 per cent.). Dose, 0.30 to 8 c.cm. (or *m*v-f℥ij).

Fluidextractum Lobeliæ (U. S. P.).—Fluid Extract of Lobelia. (Acetic Acid Menstruum.) Dose, 0.06 to 0.60 c.cm. (or *m*i-x).

Tinctura Lobeliæ Ætherea (B. P.).—Ethereal Tincture of Lobelia (20 per cent. in spirit of ether). Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Pharmacology.—Lobelia consists of "the dried leaves and tops of Lobelia inflata (Campanulaceæ)," "collected after a portion of the capsules have become inflated" (U. S. P.), "the dried flowering herb of Lobelia inflata" (B. P.)." It is a small herb, common by the waysides, with alternate leaves, an erect, hairy stem, with blue flowers in the axils of the leaves. The herb has a slight odor and a burning, tobacco-like taste. The chief constituent

[1] "Transactions of the College of Physicians of Philadelphia," 1890, and *Medical News.*

is a liquid or viscous alkaloid, **Lobeline,** combined with **Lobelic acid** and **Lobelacrin.** It forms crystallizable salts. The seeds contain about 30 per cent. of oil. A neutral principle, **Inflatin,** which seems to be inert, was isolated by Procter and Lloyd. Lewis states that lobelacrin is not a distinct principle, but that it is a mixture of lobeline lobeliate with free lobelic acid.

Physiological Action.—Lobelia has no local action, but there is some danger that it may be absorbed and produce systemic effects if applied too freely to the skin. Internally, it is a powerful depressant in large doses, and sialagogue, expectorant, emetic, and purgative, according to circumstances. This drug frequently produces headache and vertigo, and may cause death from exhaustion, or by paralysis of the respiratory centre. It depresses the circulation and action of the heart, favors diaphoresis through the violent emesis which it causes, and also lowers temperature. Lobelia also promotes the discharge of urine and has some narcotic properties. Lobeline first increases, then diminishes, and finally abolishes reflex action. It generally increases arterial pressure and stimulates the respiration. In overdoses it causes death by respiratory failure.

Should alarming symptoms follow an overdose of lobelia, the proper treatment consists in washing out the stomach with a solution of tannic acid, the external application of heat, and a hypodermic injection of alcohol, ether, ammonia, or strychnine. Subsequently, moderate doses of opium or morphine given hypodermically, will allay vomiting.

Therapy.—An infusion of lobelia (1 part to 16) has been used as a lotion in dermatitis due to rhus toxicodendron. It has valuable antispasmodic powers, though it is generally employed in too small doses, in asthma. Ringer administers 4 c.cm. (or f3j) of the tincture every hour, or 0.60 c.cm. (or *m*x) every ten minutes, immediately at the onset of a paroxysm of asthma, with marked benefit in shortening the attack. Lobelia may be employed thus for asthma:—

℞ Tinct. lobeliæ	30	c.cm. or f℥j.
Tinct. hyoscyami	15	c.cm. or f℥ss.
Aquæ camphoræ,		
Spiritus ætheris nitrosi aa	30	c.cm. or f℥j.
Syrupi pruni Virg.	15	c.cm. or f℥ss.

M. Sig.: A teaspoonful in water every half-hour or hour until relieved.

℞ Fluidextracti lobeliæ	2	c.cm. or f3ss.
Sodii bromidi	19|4	Gm. or 3v.
Syrup. ipecacuanhæ	15	c.cm. or f℥ss.
Glycerini	120	c.cm. or f℥iv.

M. Sig.: Two teaspoonfuls every one or two hours.

℞ Acetanilid.	4	Gm. or 3j.
Tinct. lobeliæ	7|5	c.cm. or f3ij.
Syr. eriodictyi aromat. (N. F.) q. s. ad	90	c.cm. or f3iij.

M. Sig.: Take a teaspoonful every quarter of an hour during attack of asthma until relieved.

Lobelia should only very exceptionally be employed as an emetic, as it produces too much nausea and depression, and when so used has caused death. For the same reason lobelia is detrimental when dyspnœa is occasioned by disease of the heart.

Hysterical convulsions yield to a teaspoonful of the tincture injected into the rectum (E. M. Hale). In angina pectoris, ten or fifteen drops will give almost immediate relief (John M. Scudder). It is also useful in asthma. Lobelia is esteemed of value in spasmodic laryngitis. The spasmodic stage of whooping-cough is often ameliorated and shortened by the exhibition of this remedy. It is, relatively, better tolerated by children than by adults. On account of its expectorant properties, lobelia is of service in bronchitis, especially when the mucus is dry, the cough hard and barking, or the expectoration is extremely tough and hard to raise. In the treatment of whooping-cough and bronchitis lobelia may be administered as follows:—

℞ Tinct. lobeliæ	7.5	c.cm. or f3ij.
Sodii bromidi	12	Gm. or 3iij.
Spiritus ætheris nitrosi	30	c.cm. or f3j.
Syrupi limonis	q. s. ad 90	c.cm. or f3iij.

M. Sig.: A half to a teaspoonful every one or two hours to a child for whooping-cough.

℞ Tinct. lobeliæ	15	c.cm. or f3ss.
Ammonii iodidi	8	Gm. or 3ij.
Spiritus ætheris comp.	60	c.cm. or f3ij.
Syrupi Tolutani	75	c.cm. or f3iiss.

M. Sig.: Two teaspoonfuls every two or three hours for bronchitis.

In constipation and fæcal impaction, the tincture of lobelia in 0.06-c.cm. (or *m*j) doses every hour promotes peristalsis and stimulates intestinal secretions; or a 0.60-c.cm. (or *m*x) dose may be given at bed-time, acting as a purgative in a similar way to tobacco.

Lobeline sulphate, a yellowish-white powder, is said to produce good results in asthma and bronchitis in doses of 0.065 to 0.38 Gm. (or gr. i-vj).

Lobeline has been employed with success, principally in the treatment of spasmodic asthma, by Dr. Silva Nunes, who claims that it is free from nauseant or irritant properties and can be subcutaneously injected. He has used it in doses of 0.01 to 0.05 Gm. (or gr. $^1/_6$-$^5/_6$) for children and 0.05 to 0.38 Gm. (or gr. $^5/_6$-vj) for adults. Dr. Nunes writes that the administration of lobeline produced a cure in eight cases of tetanus.

LORETIN. — Loretin is an iodine compound (meta-iodo-ortho-oxy-quinoline-sulphonic acid) originally prepared by Professor Claus, of Freiburg, as a substitute for iodoform. It is a yellow, crystalline powder, entirely free from odor, slightly soluble in water and alcohol, and insoluble, or nearly so, in ether and oils. With metallic oxides it combines to form salts. Its alkaline salts are readily soluble in water. The calcium salt does not dissolve in water.

Physiological Action and Therapy.—Loretin possesses antiseptic properties, does not irritate the skin, and is said to be devoid of toxic quality. This substance has been employed as a surgical dressing by Professor Schinzinger, of Freiburg. Mixed with a small quantity of calcined magnesia it can be serviceably dusted upon wounds or insufflated into cavities. A 2- to 5-per-cent. solution of the loretin-sodium salt is useful in the irrigation of wounds. Gauze impregnated with the calcium salt answers a good purpose as a dry dressing. Collodion containing loretin forms a good application to many wounds, and when painted upon a large erysipelatous surface was soon

followed by a marked reduction of fever. The same preparation was beneficial in lupus after cauterization had been practiced. Loretin powder was beneficially applied to burns and eczema. Professor Schinzinger has employed it with satisfactory results as a dressing after major operations. A favorable report of the usefulness of this remedy in veterinary surgery has been made by G. Fenzling.

Bismuth loretin is a useful application to chronic ulcers, cutaneous lesions of syphilitic origin, and moist eczema, being employed in these cases as a powder, 10-per-cent. ointment, and paste. The bismuth compound has also been given with success internally in tubercular diarrhœa.

LOSOPHAN.—Tri-iodo-metacresol. Losophan is the trade name given to the product resulting from the action of iodine on oxy-toluyl acid in the presence of an alkali. It contains 80 per cent. of iodine, and occurs in the form of white needles, which melt at 250.7° F. Losophan is slightly soluble in alcohol, insoluble in water, readily soluble in ether, chloroform, benzol, and, at a temperature above 140° F., in fixed oils. Losophan is soluble in a dilute solution of sodium hydrate, but is changed by a concentrated solution into a greenish-black, amorphous body.

Physiological Action and Therapy.—The effects of losophan must be closely observed, as it is a decided irritant. The value of this substance as a topical remedy in diseases of the skin was investigated by Dr. Edmund Saalfeld, of Berlin. He employed it in the form of a 1-per-cent. solution in 3 parts of alcohol and 1 of water, and as a 1- to 3-per-cent. ointment. It was found of service in different forms of tinea, in chronic infiltrated eczema, squamous and fissured eczema. In prurigo and paræsthesia losophan relieved itching. The application of a 1-per-cent. losophan ointment accomplished good results in certain cases of sycosis. It was useful, likewise, in acne and rosacea. In pediculosis and scabies it sometimes acted as a parasiticide. It is inapplicable to acute inflammatory diseases of the skin. Losophan is recommended by Dr. Descottes as a serviceable application to leg-ulcers, chancres, and chancroids. He employed solutions and ointments containing 8, 10, or 20 per cent. without, as a result, perceiving any irritation of the skin.

LUPULINUM (U. S. P., B. P.).—**Lupulin.**
Dose, 0.13 to 0.32 Gm. (or gr. ii-v).
LUPULUS (B. P.).—**Hops.** (See **Humulus.**)

Preparations of Lupulinum.

Fluidextractum Lupulini (U. S. P.).—Extract of Lupulin. Dose, 2 to 7.5 c.cm. (or f3ss-ij).

Oleoresinæ Lupulini (U. S. P.).—Oleoresin of Lupulin. Dose, 0.60 to 2 c.cm. (or *m*x-xxx).

"The glandular trichomes separated from the fruit of Humulus lupulus (Moraceæ)."

LYCOPERDON.—Puff-ball. Lycoperdon solidum or giganteum (Fungi) in powder is hæmostatic. It is credited with narcotic properties, but has been occasionally used for food.

LYCOPODIUM (U. S. P.).—**Lycopodium.**

Pharmacology. — "The spores of Lycopodium clavatum and of other species of Lycopodium (Lycopodiaceæ)." They contain nearly 50 per cent. of an oil similar to expressed oil of almonds. It contains about 2 per cent. of lycoperdic acid.

Physiological Action.—Lycopodium, given internally, was supposed in the past to have diuretic and antispasmodic action. Merrell states[1] that the eclectics claim that lycopodium acts as a stimulant to the sympathetic visceral nerves, and therefore is of value in functional diseases of the organs under their control. Greene believes that lycopodium stimulates the liver, thus lessening the work of the kidneys, and that it also has an anæsthetic effect upon the mucous membranes.

Therapy.—Lycopodium is a bland powder, and (unless contaminated by addition of potato-starch) is an excellent dusting-powder for intertrigo, or to prevent excoriations, especially in infants.

Lycopodium has also been employed for the treatment of rheumatism, dyspepsia, pulmonary and renal diseases. Some physicians use it triturated with sugar of milk, in minute doses, for affections of the mucous tract, particularly dyspepsia, pyrosis, ileocolitis, and for diseases of the urinary organs.

LYCOPUS.—Bugle-weed. The Lycopus Virginicus (Labiatæ) is a small herb common in wet places, resembling the mints, but wanting their aroma. The whole herb is used in decoction or infusion, but a fluid extract is the most eligible form in which to give it. It contains a volatile oil, with a little resin and tannin.

Physiological Action and Therapy. — Bugle-weed is astringent and sedative. It has been used in pulmonary disorders and phthisis to allay fever, cough, and expectoration. Bugle-weed is likewise stated to check hæmorrhage from the lungs and other organs. It reduces the force and frequency of the heart's action, and acts as a sedative, and in large doses is depressant to the nervous system. By virtue of the volatile oil it is somewhat carminative, and in small doses is considered tonic. It has been used in organic and functional heart disease, and in exophthalmos by Dr. Hector.[2] It is of service in spasmodic cough in combination with belladonna, but rarely used.

LYSOL.—A liquid coal-tar product, containing 50 per cent. of pure cresol. It is produced by dissolving tar oil in fat, and saponifying and dissolving in alcohol. In 1-per-cent. solution, it has been used as an antiseptic vaginal douche, and wound-dressing. With the addition of 1 per cent. of sodium hydrate, it is a useful agent for rendering tuberculosis sputa innocuous. It is claimed to be five times stronger than phenol as an antiseptic, and only one-eighth as toxic.

MAGNESIUM.—The metal **Magnesium** (Mg).

U. S. P. Salts and Preparations.

Magnesii Oxidum.—Light Magnesia, Calcined Magnesia. Dose, 4 to 15.5 Gm. (or ʒi-iv).

Magnesii Oxidum Ponderosum.—Heavy Magnesia. Dose, 2 to 15.5 Gm. (or ʒss-iv).

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[1] *The Medical Standard*, Chicago, Jan., 1891.

[2] *Chicago Medical Times*, June, 1889.

Magnesii Carbonas.—Magnesium Carbonate, Heavy Magnesium Carbonate. Dose, 15.5 to 62 Gm. (or ℥ss-ij).

Magnesii Sulphas.—Magnesium Sulphate, Epsom Salt. Dose, 4 to 31 Gm. (or 3i-℥j).

Magnesii Sulphatis Effervescens.—Effervescent Sulphate of Magnesia. Dose, 4 to 15 Gm. (or 3i-iv).

Liquor Magnesii Citratis.—Solution of Magnesium Citrate (dispensed in bottles containing 473 c.cm., or Oj, effervescing when opened). Dose, 120 to 473 c.cm. (or f℥iv-xvj).

Ferri Hydroxidum cum Magnesia.—See *Ferrum*.

Pulvis Rhei Compositus.—See *Rheum*.

Talcum.—Magnesium Silicate. A Native.

Talcum Purificata.—Purified Talcum. For external use as dusting powder.

B. P. Salts and Preparations.

Magnesia Levis.—Light Magnesia, Light Calcined Magnesia, Light Magnesium Oxide. Dose, 0.32 to 2 Gm. (or gr. v-xxx) for repeated administration; for single administration, 2 to 4 Gm. (or gr. xxx-lx).

Magnesia Ponderosa.—Heavy Magnesia, Heavy Calcined Magnesia, Heavy Magnesium Oxide. Dose, 0.32 to 2 Gm. (or gr. v-xxx) for repeated administration; for single administration, 2 to 4 Gm. (or 3ss-j).

Magnesii Carbonas Levis.—Light Magnesium Carbonate. Dose, 0.32 to 2 Gm. (or gr. v-xxx) for repeated administration; for single administration, 2 to 4 Gm. (or gr. xxx-lx).

Magnesii Carbonas Ponderosus.—Heavy Magnesium Carbonate. Dose, 0.32 to 2 Gm. (or gr. v-xxx) for repeated administration; for single administration, 2 to 4 Gm. (or 3ss-j).

Magnesii Sulphas.—Magnesium Sulphate, Epsom Salt. Dose, 2 to 8 Gm. (or 3ss-ij) for repeated administration; single administration, 8 to 15.5 Gm. (or 3ii-iv).

Magnesii Sulphas Effervescens.—Effervescent Magnesium Sulphate. Dose, 4 to 15.5 Gm. (or 3i-iv) for repeated administration; for single administration, 15.5 to 31 Gm. (or ℥ss-j).

Liquor Magnesii Carbonatis.—Solution of Magnesium Carbonate, Fluid Magnesia. Dose, 30 to 60 c.cm. (or f℥i-ij).

Pharmacology.—Magnesium is a light, silver-like metal, which, rolled in thin plates or ribbons, can be ignited, and will burn with a brilliant, white flame, forming a white smoke of the oxide. Magnesium carbonate is of two varieties, one heavier than the other; by calcination in a crucible they yield the two forms of magnesium oxide, light and heavy magnesia. Magnesium carbonate and the oxides are white in color, alkaline, insoluble, and tasteless, or nearly so. The sulphate is in colorless crystals, of a rather nauseous, bitter taste, and quite soluble in water; it occurs native, and is a constituent of sea-water. It enters into the compound infusion of senna (U. S. P.). The sulphite is a white, crystalline powder, obtained from the preceding; it also is of slightly bitter taste, and is soluble in 20 parts of water. It oxidizes upon exposure to the air.

Physiological Action.—Magnesia (or calcined magnesia, as it is commonly called) and the carbonate have a slightly astringent effect upon the skin. When taken into the stomach, they are antacid and laxative. Magnesia may be used as an antidote to acids, and also in poisoning by phosphorus, copper, or arsenic; for the latter a U. S. P. official combination with ferric hydrate is provided. The citrate and sulphate are saline cathartics; the latter has no direct cholagogic effect, as was formerly thought, but acts principally as an irritant to the intestinal glands.

As a metallic poison, M. Binet has demonstrated that magnesia arrests the heart in diastole and causes a precocious paralysis of the peripheral

nervous system. It was shown by Claude Bernard that magnesium sulphate produces a purgative effect when injected into a vein.

S. J. Meltzer has found that magnesium salts, especially the sulphate, have the property when applied to nerve-tissue of exerting a profoundly inhibitory effect. Intravenous injections inhibit respiration and cause paralysis of the entire body. Subcutaneous injections produce deep narcosis with complete muscular relaxation. Subarachnoid injection by lumbar puncture causes almost immediate anæsthesia and paralysis of the lower half of the body, lasting several hours.

Therapy.—Magnesium carbonate, which comes in small cubes, is used locally to dry the skin and prevent chafing or excoriation. Internally it is an antacid for indigestion, heartburn, and pyrosis, and is used as a laxative for infants. Sick headache, dependent upon gastric acidity, is relieved by the administration of magnesium carbonate. Magnesia ponderosa is a convenient form in which to administer the oxide; it may be given suspended in orange-juice or milk. Magnesia has been used with variable success in sympathetic vomiting and the vomiting of pregnancy. It is of service in neutralizing uric acid, and may, therefore, be employed in lithiasis, though inferior in this condition to lithia. In adults, if constantly administered, it may form large concretions in the intestines. The citrate is more purgative, and, in the U. S. P. official effervescent salt and solution, is a pleasant cathartic for simple evacuation of the bowels. The sulphate is more active, causing free watery discharges. It may be given in repeated small doses, every hour, in order to overcome fæcal impaction; also in the constipation of lead poisoning:—

℞ Magnesii sulphatis	8	Gm. or 3ij.
Morphinæ sulphatis	.065	Gm. or gr. j.
Aquæ menthæ piperitæ	90	c.cm. or f℥iij.

M. Sig.: A tablespoonful every two hours in lead colic.

In surgery, the discovery by Dr. Meltzer of the method of producing analgesia of the lower extremities by intraspinal injection of magnesium sulphate, has been utilized in operating. The dose employed was 1 c.cm. of a 25-per-cent. solution, for each twenty pounds of the weight of the patient. The best time for operation is three or four hours after the injection. Sensation and motion return in from 8 to 24 hours, without evil after-effects.

Dr. Matthew Hay advocates the use of magnesium sulphate in the treatment of pleural and other serous effusions, administering 31 to 62 Gm. (or ℥i-ij) at a dose and restricting the fluids drunk. The citrate and sulphate cause little, if any, irritation, and may safely be used in enteritis or in peritonitis to keep the bowels open. In many acute febrile disorders, small doses of these salines are beneficial, and in atonic conditions they may be combined with iron. The purgative mineral waters—Friedrichshall, Pullna, Seidlitz, and Hunyadi Janos—owe their property principally to magnesium sulphate. The bitter taste of the Epsom salt is covered by adding some coffee to its solution. It is the cathartic to administer in cases of the peculiar diarrhœa caused by impacted masses of fæces in the colon, and in dysentery it proves very serviceable associated with aromatic sulphuric acid and laudanum. In acute dysentery, magnesium sulphate sometimes acts remarkably well, often removing fever, the blood and mucus from the stools, together with the tenesmus.

Dr. A. W. D. Leahy, who has treated ninety-five cases of acute dysentery with magnesium sulphate, with only two deaths, recommends the remedy, combined as follows: "Take a sufficient quantity of sulphate of magnesia to saturate 210 c.cm. (or f℥vij) of water, and to this solution add 30 c.cm. (or f℥j) of diluted sulphuric acid. The dose of this is a tablespoonful every hour or two in a wineglassful of water until it operates. Sulphate of morphine may be added, or a starch enema with laudanum.[1] A little tincture of cardamom will make the mixture more agreeable.

In a case of tetanus, the subarachnoid introduction of magnesium sulphate has afforded marked relief, and after a few more injections the patient recovered.

That a small dose of Epsom salt hypodermically injected produces a purgative effect, first asserted by Luton, has since received demonstration by Dr. J. Percy Wade. The dose injected varied from 0.13 to 0.29 Gm. (or gr. ii-ivss). The small was found to be as efficacious as the larger dose. The procedure occasioned no local reaction. A small dose repeated within a short time had a better effect than a single dose of larger size. The method was successful in 67 per cent., and in only two patients was it a constant failure. This expedient was adopted in the treatment of constipation in the insane by George H. Rohé. In repeating these experiments, Fincke failed to obtain an equal degree of success, the proportion of cases in which a purgative effect was produced amounting only to 18 per cent. In anæmia and chlorosis, which Clarke attributed to fæcal intoxication, the following combination forms a useful tonic laxative; it is known as **Mistura ferrosalina**:—

℞ Magnesii sulphatis	31	Gm.	or ℥j.
Potassii bitartratis	4	Gm.	or ʒj.
Ferri sulphat. exsiccat.	65	Gm.	or gr. x.
Aquæ	1000	c.cm.	or Oiif℥ij.

M. Sig.: A wineglassful half an hour before breakfast each morning.

Where a more-decided purgative effect is desired, the remedies should be given in more concentrated form, thus: equal parts of Rochelle and Epsom salts may be taken,—say, each a teaspoonful, dissolved in a small quantity of water; this dose to be repeated hourly until bowels move.

The sulphate relieves congestion of the kidneys, general anasarca, the œdema of lung or brain which may occur in Bright's disease, ascites, uræmia, rectal and pelvic hæmorrhage, especially when accompanied by constipation. It is likewise of service in stricture or cancer of the rectum and fissure of the anus by liquefying the fæcal passages. This and other saline purgatives possess the valuable property of being able to act painlessly upon the bowels of a patient who is fully under the influence of opium: a fact which renders them additionally useful in rectal carcinoma. When the stomach is too irritable to permit its administration by the mouth, magnesium sulphate may be given in the dose of 62 Gm. (or ʒij) by enema with complete success. Epsom salt is likewise of service in the treatment of lead colic, combined with a little dilute sulphuric acid, tincture of opium, and syrup of ginger. The effervescent magnesium sulphate of the British Pharmacopœia is useful as a substitute for saline mineral waters.

Magnesium sulphite has been recommended as a remedy for infectious

[1] *Lancet*, Oct. 4, 1890.

dyspepsia and inflammatory or febrile diseases of infectious origin. This salt has been found useful, likewise, in diphtheria. It is given in the form of a tablet, allowed to dissolve slowly in the mouth, or the affected parts are dusted with the powdered drug. It is said to promote a rapid disappearance of the false membrane.

MAGNOLIA.—Magnolia. The bark of Magnolia glauca, M. acuminta, and M. tripetala (Magnoliaceæ), all indigenous trees of our Eastern and Southern States. The drug contains, besides resin and tannin, a bitter crystallizable, neutral principle, **Magnolin**, soluble in alcohol, but not in water. A fluid extract made with alcohol is the best preparation.

Physiological Action.—An aromatic bitter, which can be used in appropriate dose as a tonic or as an antiperiodic. Diaphoretic properties are also ascribed to magnolia.

Therapy. — Magnolia is used in debilitated conditions of the system attending malarial attacks, rheumatism, etc. In intermittent fevers it has been used successfully as a substitute for quinine.

MAIDIS STIGMATA.—Corn-silk.

Pharmacology.—The styles and stigmas (Stigmata maidis, corn-silk) of Zea mays, Linné (Gramineæ), maize, or Indian corn, gathered when the tassel has shed its pollen. They are said to contain an active principle which is termed **Maizenic Acid**, which has been recommended for use in doses of 0.008 Gm. (or gr. $^1/_8$). The plant is too well known to need any description. A native of America, it has been extensively cultivated in all temperate climates. Some of its preparations are the following: Extractum stigmatorum maidis fluidum (fluid extract of corn-silk); dose, 4 to 7.5 c.cm. (or f℥i-ij). Vinum stigmatorum maidis (wine of corn-silk); dose, 15 to 30 c.cm. (or f℥ss-j). Syrupus stigmatorum maidis (syrup of corn-silk); dose, 15 to 30 c.cm. (or f℥ss-j).

Physiological Action and Therapy.—The preparations of corn-silk are palatable and well tolerated by the stomach. Its principal action is as a diuretic, and it likewise seems to exert a sedative action upon the urinary passages. When œdema is associated with an enfeebled condition of the heart, corn-silk, by exciting diuresis, acts indirectly as a heart-tonic; the pulse becomes regular and increases in force, while arterial tension is raised. Corn-silk is of service in congestion of the kidney, chronic nephritis, and pyelitis. During its administration, albuminuria is lessened and the excretion of urea is augmented. It also answers a good purpose in suppression of urine. In lithiasis, renal colic, and hæmaturia, corn-silk has been found of benefit.

It is useful in uric acid and phosphatic gravel. Irritability of the bladder, acute and chronic cystitis (especially the latter), retention of urine, and prostatitis are ameliorated by this remedy. According to Dufau, it is contraindicated in acute traumatic cystitis and gonorrhœal cystitis, increasing the pain of the malady. Other observers, however, report good results from its use in cystitis dependent upon gonorrhœa or stricture. Some, after having thoroughly washed out the bladder, employ the fluid extract of corn-silk diluted with water as an injection, with asserted good results. Others speak favorably of its use as an internal remedy in acute gonorrhœa. It has been given with success in nocturnal incontinence of urine. In œdema of the

lower extremities, associated with disease of the heart and in general dropsy from heart or kidney disease, corn-silk is serviceable alone or combined thus:—

℞ Fluidextracti stigmatorum maidis ..... 45| c.cm. or f℥iss.
Fluidextracti taraxaci,
Infusi digitalis ..... aa 90| c.cm. or f℥iij.
M. Sig.: Two teaspoonfuls in water every three or four hours.

℞ Fluidextracti stigmatorum maidis ..... 60| c.cm. or f℥ij.
Potassii bitartratis ..... 12| Gm. or ℥iij.
Spiritus ætheris nitrosi ..... 60| c.cm. or f℥ij.
M. Sig.: A half-tablespoonful every two or three hours.

Corn-husk.—Dr. J. W. Pruitt, of Russelville, Ark., asserts that a distilled extract prepared from the husk of Indian corn is an excellent remedy in chronic malaria. It is said to control temperature, allay irritability of the stomach, regulate the functions of the liver and kidneys, and reduce enlargement of the spleen. It often exerts a mild diuretic influence. The extract is clear and transparent, resembling boiled green corn in odor and taste. It can be preserved by the addition of alcohol and glycerin, and is administered in the dose of 4 to 7.5 c.cm. (or f℥i-ij) every two or three hours.

Ustilago Maidis.—Ustilago, or corn-smut, is a fungus resembling ergot, growing upon all parts of the Zea mays. It should be preserved in a dry state, and should not be kept longer than a year. Corn-smut contains about 5 per cent. of an amorphous, reddish-brown substance resembling sclerotic acid.

The physiological action of ustilago has been studied by Dr. James Mitchell, who ascertained that it destroys consciousness, paralyzes first the sensory tract of the cord and subsequently the motor centres of the cord and motor nerves.

The fluid extract is used in a similar manner to ergot, in order to stimulate the contractions of the uterus during and after labor. Dr. Dorland states that ustilago excites clonic rather than tonic contractions of the womb during labor, and is, therefore, to be preferred to ergot. Estachy has given this remedy with success in hæmoptysis and spermatorrhœa.

The usual dose is about 2 Gm. (or gr. xxx), or 1 to 5 c.cm. (or *m*xv-lxxv) of a fluid extract.

MALAKIN.—Salicyl-paraphenetidin. Malakin is the name bestowed upon a combination of salicylic aldehyde with paraphenetidin and is closely related in chemical composition to phenacetin. The compound appears in the form of small, silky needles, of a yellow color, insoluble in water, slightly soluble in cold alcohol, but readily dissolving in boiling alcohol. It is insoluble in alkaline carbonates, but dissolves in a soda-lye, forming a soda combination of an intense-yellow color. Malakin is decomposed by the mineral acids, even when these are considerably diluted. It contains about 50 per cent. of salicylic acid. The latter substance, consequently, operates in the nascent state, and apparently in smaller doses than when administered by the mouth under its own form.

Physiological Action and Therapy.—The effects of this drug have been investigated by Dr. Jaquet, of Bale,[1] who found that it exerted no influence

[1] *Le Progrès Medical*, No. 51, 1892; *The Medical Bulletin*, Feb., 1894.

upon the respiration, heart, or blood-pressure of rabbits. That it was absorbed when taken into the stomach was shown by the presence of salicylic acid in the urine. It is decomposed by the gastric juice, and is insoluble in the intestinal fluids. It is slowly broken up in the stomach, and the absorption of its components proceeds gradually, for which reason its action is not manifested till after the lapse of a certain time. The remedy is well borne. Montagnon asserts that malakin has a diuretic effect and facilitates the elimination of uric acid.

In daily doses of 4 to 6 Gm. (or 3i-iss) malakin has a beneficial action in rheumatism. The temperature is reduced on the second or third day of its administration, the local inflammation is diminished, and the pain is gradually lessened. It does not cause, as far as has yet been observed, any buzzing in the ears, loss of appetite, or vomiting. Abundant sweating has sometimes been seen at the period of crisis, and in one case Dr. von Bauer observed unpleasant symptoms of collapse after eight doses of 0.50 Gm. (or gr. viij) each had been taken at hourly intervals. The fall of temperature produced by this substance generally begins about two hours after a dose has been taken. The temperature slowly decreases, reaches a minimum at the end of three to four hours, when it commences to ascend. Malakin is not especially efficacious in the violent and persistent hyperpyrexia of the eruptive fevers and pneumonia. It renders the most efficient service in the later stages of typhoid fever and in the fever of tuberculosis. It generally proved beneficial in pleurisy and peritonitis. Malakin is thought to be particularly appropriate for use in chronic maladies and when the patient is enfeebled, on account of its freedom from depressant effect. According to Dr. von Bauer, of Vienna, its antipyretic influence is less than that of antipyrin and phenacetin. Favorable results have also been obtained from the use of malakin in neuralgic affections.

MALLEIN.—Mallein is an organic product, a glycerin extract of the soluble substances produced by the glanders bacillus, when grown in 5-per-cent. glycerin beef bouillon. It produces marked disturbance when injected into an animal, suffering with glanders; and is used principally for diagnosis in veterinary practice.

MALTUM (U. S. P.), **Malt**, and **EXTRACTUM MALTI** (U. S. P.).—**Extract of Malt.**

Pharmacology.—Malt is the seed of barley, Hordeum distichum (Gramineæ), partially germinated by artificial means and dried. Extract of malt is made with water at a moderate heat and evaporated by means of a vacuum apparatus to the consistency of thick honey. The sweet principle is malt-sugar, or **Maltose.** The method adopted in making the "diastasic" extract of malt, the author is informed by Mr. Louis Genois, is to macerate well-malted barley in warm water for several hours, until the starchy matter has been changed to dextrin and maltose; the infusion is then simmered with fresh hops at a temperature under 160° F., in order to retain the diastase and other albuminoids unimpaired, and the resulting liquid subjected to fermentation until the percentage of extractive matter amounts to about 12 per cent. and that of alcohol to about 4 per cent. This takes from seventy-five to one hundred days. When properly made, the extract and diastasic extract of malt not only contain all the nutritive substances of malted barley, but also a peculiar ferment (diastase), which has the power of converting

starch to the soluble form, thus assisting in the digestion of amylaceous food. The official malt extract, resembling honey in density, is a good vehicle for iron, the hypophosphites, quinine, etc.

Therapy.—Extract of malt is a valuable food, in concentrated form, and easily assimilated. It is pleasant to the taste, can be eaten upon bread or mixed with milk, and agrees with the digestive organs. It forms, with an equal quantity of good codliver-oil, an emulsion which children readily take, and which is useful in convalescence or wasting diseases. The water may be entirely extracted in the vacuum apparatus, giving us dry extract of malt, which is the basis of some largely-used food preparations for young children and invalids. The other form of liquid malt just referred to is made by fermentation, and several varieties of this malt are sold, varying in alcoholic strength from the smallest traces to 8 or 10 per cent., making, in fact, a beer. Bitter liquid malt is a valuable remedy in cases of general debility, deficient digestive power, or loss of appetite. It is probably one of the best agents for increasing muscular tissue and augmenting fat; many persons gain considerable weight from a malt course. The use of malt liquors has been already referred to under the head of **Alcohol.**

MANACA.—Brunfelsia hopeana (Scrophularineæ), Manaca, or Mercurio vegetal is a Brazilian shrub, the root of which possesses medicinal virtues. The bark of the root, when reduced to powder, has a yellowish-brown color and an odor which recalls that of cornmeal. An energetic alkaloid, difficult to isolate in a state of purity, has been discovered by Dragendorff. Manaca is official in the Brazilian dispensatories, the dose of the powdered root being given as 0.50 to 1.30 Gm. (or gr. viii-xx). In this country a fluid extract has been made and may be given in doses of 0.30 to 1.20 c.cm. (or *m*v-xx).

Physiological Action.—According to the investigations of Dr. E. P. Brewer,[1] of Norwich, Conn., manaca has no influence upon the brain or special senses, but stimulates the motor centres of the spinal cord, and in full doses abolishes the reflex function of the cord. It depresses the cardiac and respiratory reflex centres and stimulates the glands, especially the salivary, gastric, intestinal, and cutaneous; also the liver and kidneys. Signs that its physiological action is produced are, in man, a feeling of band-like constriction around the head, nausea, and profuse perspiration. When these symptoms manifest themselves the remedy should be suspended or reduced in quantity. In its home, manaca is regarded as purgative, diuretic, and emmenagogic; also antisyphilitic and antirheumatic. In small doses it is resolvent, in large doses an acrid poison.

Therapy.—Manaca has been principally used as a remedy in rheumatism. In the acute form of this disease the articular pain and swelling not infrequently subside rapidly after the development of the physiological effects of the drug. In a considerable proportion of cases chronic rheumatism is notably ameliorated by the administration of manaca. In muscular rheumatism this drug is likewise serviceable, and may be profitably combined with potassium iodide and cimicifuga, as in the following prescription:—

℞ Potassii iodidi	6	Gm. or ʒiss.
Fluidextract. cimicifugæ,		
Fluidextract. manacæ .....aa	6	c.cm. or fʒiss.
Syrup. sarsaparillæ comp. .....q. s. ad	120	c.cm. or fʒiv.

M. Sig.: A tablespoonful four times a day.

[1] *Therapeutic Gazette*, 1882, p. 326.

In neuralgia of rheumatic origin manaca may sometimes be used with advantage. In scrofulous manifestations and in secondary syphilis it has been administered with asserted good effects. From its action upon the secretions, Dr. Brewer infers that it might be of benefit in gastric and gastro-duodenal catarrh and jaundice dependent upon the latter condition, as well as in simple jaundice due to inaction of the liver.

MANGANUM.—The metal **Manganese** (Mn).

Preparations.

Mangani Dioxidum Præcipitatum (U. S. P.).—Precipitated Manganese Dioxide. Dose, 0.13 to 0.65 Gm. (or gr. ii-x).

Mangani Sulphas (U. S. P.).—Manganese Sulphate. Dose, 0.13 to 0.32 Gm. (or gr. ii-v).

Mangani Hypophosphis (U. S. P.).—Hypophosphite of Manganese. Dose, 0.13 to 0.32 Gm. (or gr. ii-v).

Potassii Permanganas (U. S. P., B. P.).—Potassium Permanganate. Dose, 0.03 to 0.065 Gm. (or gr. ss-j). B. P., 0.065 to 0.20 Gm. (or gr. i-iij).

Liquor Potassii Permanganatis (B. P.).—Solution of Potassium Permanganate (1 per cent.). Dose, 7.5 to 15 c.cm. (or f3ii-iv).

Pharmacology.—Manganese is whitish gray, very hard, and almost as infusible as platinum, but in the metallic state is not used in medicine or surgery. It exists in small quantity in the blood and bile, in company with iron. The dioxide, or black oxide, treated with hydrochloric acid, yields manganous chloride, water, and chlorine, and is sometimes used to supply chlorine in the sick-room. When heated with potassium chlorate, it undergoes no change, but favors the steady evolution of oxygen-gas from the potassium salt, and this method is generally followed for the production of oxygen on a small scale for laboratory purposes. Permanganate of potassium combines with and destroys organic substances, and is a chemical antidote to morphine.

Physiological Action. — The sulphate is an emetic and purgative in doses of 4 to 8 Gm. (or 3i-ij), and has also decided cholagogic properties; in smaller doses it may be used as an hepatic stimulant. Overdoses of manganese salts, especially if long continued, depress the system, lower the heart-action, favor fatty degeneration of the muscles and of the liver, and reduce blood-pressure. Excessive doses occasion gastro-enteritis. These salts are intestinal irritants. The black oxide has emmenagogic properties. Small doses favor hæmatosis, acting, like iron, as a tonic. Potassium permanganate is an oxidizing agent and a generator of ozone; it is a valuable antiseptic and disinfectant. In the stomach it arrests fermentation, but probably is at once decomposed as a result of its combination with organic material, so that it is not absorbed into the circulation in its own form; but, nevertheless, in whatever form it finally is absorbed, it does exercise a systemic effect, and is considered a good emmenagogue.

Therapy.—In solution (0.065 to 0.32 Gm., or gr. i-v, to 30 c.cm., or f℥j, of water, or even more dilute) the permanganate is useful as a deodorant to foul wounds, compound fractures, and ulcers; it is also injected into the nose in ozæna, or used as a mouth-wash in diphtheria, scarlatina, necrosis of jaw, cancer of the tongue, and conditions causing foul breath. In bromidrosis (fetid perspiration) of the feet, sponging with permanganate solution and the use of a drying-powder of starch and salicylic acid will often correct the

condition. Injections of permanganate are sometimes slightly irritating, or even caustic, and they should not be used in gunshot wounds of the abdomen or abscesses connected with the peritoneal cavity, for fear of injurious consequences. In treating purulent discharges from the external ear, the permanganate is thought to favor perforation of the tympanic membrane, and if used at all here it should be in very dilute solution. Dr. Albert Terson has found solutions of potassium permanganate useful in purulent ophthalmia. He employs a solution varying from 1-2000 to 1-5000.

In the strength of 0.13 Gm. to 30 c.cm. (or gr. ii-f℥j), permanganate has been used with success as an injection in gonorrhœa and leucorrhœa. An ointment containing manganese dioxide has been used in tinea, scabies, and porrigo. M. Galezowski, of Paris, has reported good results from the use of baths of potassium permanganate in the treatment of small-pox. In the treatment of disorders of the uterine functions many practitioners speak highly of the manganese salts, especially when the trouble is due to functional, and not to any mechanical or obstructive, cause. Dr. John N. Upshur, of Richmond, Va., has observed benefit in membranous dysmenorrhœa from the use of the oxide (0.13 Gm., or gr. ij, each) in gelatin-coated pills, given four or five times daily. The permanganate is often not well borne by the stomach. Manganese dioxide is also of service in amenorrhœa, or sudden suppression of the menses as a result of cold, and when the menstrual discharge is scanty and irregular. Manganese is useful in anæmia and chlorosis, particularly when given in conjunction with iron:—

℞ Potassii permanganatis ..... | 32 Gm. or gr. v.
Mass. ferri carbonatis,
Quininæ sulphatis ..... aa | 65 Gm. or gr. x.
M. et ft. pil. no. x.
Sig.: A pill three or four times a day.

As an emmenagogue in chlorosis, Dr. Homer C. Bloom highly recommends the following prescription:—

℞ Ferri peptonat. ..... | 75 Gm. or gr. xij.
Mangani peptonat.,
Acid. oxalici ..... aa | 13 Gm. or gr. ij.
Alcohol. ..... 11 | c.cm. or f℥iij.
Aquæ .....q. s. ad 120 | c.cm. or f℥iv.
M. Sig.: Two teaspoonfuls three times a day.

Dr. Charles O'Donovan, of Baltimore, finds the black oxide of manganese to be the most satisfactory treatment for dysmenorrhœa, in doses of 0.13 Gm. (or gr. ij) about an hour after each meal, combined, if desired, with iron, or other adjuvants. No deleterious effects were observed even when the remedy was long continued.

An unofficial syrup of the iodide of iron and manganese is a good alterative tonic in scrofula and the debility due to prolonged suppuration. The oxide, in doses of 0.65 to 1 Gm. (or gr. x-xv), is recommended by Dr. Leared in gastrodynia and pyrosis. The same preparation relieves catarrhal or malarial jaundice, especially when combined as follows:—

℞ Mangani oxidi ..... 2 | Gm. or 3ss.
Resinæ podophylli ..... | 13 Gm. or gr. ij.
Extract. belladonnæ folior. ..... | 065 Gm. or gr. j.
M. et ft. capsulæ no. x.
Sig.: A capsule three or four times a day, in catarrhal jaundice.

The permanganate is of avail in flatulent dyspepsia and lithiasis. It has occasionally produced good results in acute rheumatism, and has been employed, with varying success, in a number of infectious disorders, as scarlet fever, diphtheria, erysipelas, septicæmia, and pyæmia. In the first two named, this remedy, in solution, is applied to the throat with advantage. It is also recommended, locally and internally; in snake-bites and in erysipelas the local application of a solution containing 8 to 12 Gm. to 500 c.cm. (or ℥ii-iii to Oif℥j) of water is beneficial.

Dr. William Moor, of New York, has called the attention of the profession to the fact that potassium permanganate is a chemical antidote for morphine. The presence of albuminoids and peptones does not interfere with this reaction. He has shown that an equal quantity, grain for grain, of permanganate is antidotal in cases of poisoning by morphine. In cases of poisoning by opium, laudanum, or the uncombined alkaloid, he advises acidulation of the stomach-contents with diluted sulphuric acid, or white vinegar, in order that the insoluble morphine be converted into a soluble salt. To secure the most positive results from this plan of treatment it is said to be necessary that the antidote should act upon the alkaloid before absorption has occurred, but Professor Hitzig has demonstrated that morphine, subcutaneously injected into dogs, is excreted by the glandular lining of the stomach, so that it may have some value even at a late period. A number of cases of opium or morphine poisoning which have been treated by means of potassium permanganate seem to show that it may be efficient when some time has elapsed since the poison was swallowed, but as Cerna has shown it is not a physiological antidote, and Ringer states that it is not adapted to hypodermic use, being instantly decomposed by the blood.

Dr. Moor has experimented with other alkaloids, but finds that potassium permanganate is without effect on atropine, cocaine, veratrine, pilocarpine, aconitine, and strychnine.

Professor Bokái recommends the administration of potassium permanganate in phosphorus poisoning, upon the ground that it converts the phosphorus into orthophosphoric acid, which is free from toxic action. Dr. Hognos, of Budapest, has successfully treated in this manner two cases, in both of which a large quantity of phosphorus had been taken. After the stomach had been washed out with tepid water, about a pint of $^1/_{10}$-of-1-per-cent. solution of permanganate was injected into the stomach and allowed to remain.

Antal has experimentally found that animals to which muscarine, strychnine, colchicum, oil of savin, and oxalic acid had been administered, followed by a $^1/_2$- to $^1/_3$-per-cent. solution of permanganate, recovered, but control animals, to which the antidote was not given, perished.

Experiments upon animals have led Dr. J. V. Kossa to believe that potassium permanganate is likewise an efficient antidote to hydrocyanic acid and potassium cyanide.

Manganese sulphate has been used in chronic rheumatism and neuralgia, but with doubtful results.

MANGOSTANA.—Mangosteen. The rind of the fruit of the mango, or Garcinia mangostana (Guttiferæ), growing in India, contains tannin and a bitter, crystallizable principle, **Mangostin.** The fruit is about the size of a small orange; the rind is hard, dark brown, smooth, inodorous, with a bitter, astringent taste.

Therapy.—Used in diarrhœa and dysentery; also in the form of decoction, as an astringent, in sore throat, nasal catarrh, leucorrhœa, etc. A fluid extract of mango (dose, 2 to 4 c.cm., or f℥ss-j), made from the bark of Mangifera Indica, of the same natural order as the preceding, has very much the same properties and is used for the same purposes. It is also recommended as a hæmostatic.

MANNA (U. S. P., B. P.).—**Manna.**

Dose, 4 to 31 Gm. (or ℥i-℥j).

Preparation.

Infusum Sennæ Compositum (U. S. P.).—Compound Infusion of Senna, Black Draught (consists of senna, 6; manna, 12; magnesium sulphate, 12; fennel, 2; boiling water, 80; cold water, q. s. ad 100 c.cm.). Dose, 120 to 240 c.cm. (or f℥iv-viij). (Infusum Sennæ (B. P.) contains no manna.)

Pharmacology.—Manna is "the concrete saccharine exudation of the Fraxinus ornus (Oleaceæ)," or manna-ash of Italy, Sicily, and Asia Minor; also growing elsewhere, but yielding manna only in southern climates. Other sources of manna exist, as the tamarisk, oak, and larch, and a small, leguminous plant of India (Alhagi manna); but neither of these is of any importance compared with that derived from the flowering ash-tree, which is the universally-known manna, both commercially and medicinally. It contains **Mannite** (70 to 80 per cent.), a sugar-like substance, and traces of **Fraxin,** a neutral, bitter substance found in the bark of several species of ash; also glucose, resin, mucilage, etc. The flake-manna is the selected, homogeneous, clear masses; manna, in sorts, contains more or less foreign material, such as straw, chips, etc. The best sort is scarce and expensive. There are no official preparations, except that manna is a constituent of compound infusion of senna (U. S. P.), or black draught, which a former generation of physicians especially favored.

Therapy.—Manna is laxative in doses of 31 or 46.5 Gm. (or ℥i-iss) for adults, but is liable to cause flatulence and colic. It has been used for children, boiled in milk, alone or combined with senna, or it may be eaten as a sort of sugar, 4 to 8 Gm. (or ℥i-ij) at a time. Molasses-candy is also a good laxative, and is considerably cheaper.

MANZANITA.—The Arctostaphylos glauca (Ericaceæ) is a native of California. Its leaves possess medicinal properties, due to **Tannin, Arbutin,** and probably, also, **Ericolin** and **Ursone,** resembling uva ursa in composition and medicinal effects.

Physiological Action.—The drug is astringent, and in small doses tonic and carminative. It is decidedly diuretic.

Therapy.—Manzanita is useful in various affections of the urinary tract, pyelitis, cystitis, stone in the kidneys or bladder; also in strangury, incontinence of urine, irritation of bladder, etc. It is best given in the form of a fluid extract (dilute alcoholic) in doses of 2 to 7.5 c.cm. (or f℥ss-ij) four to six times a day.

MARANTA.—Arrowroot-starch. The fecula from the rhizome of the Maranta arundinaceæ (Cannaceæ), of the West Indies and South America, consists wholly of a beautifully-white starch in fine granules. It is used in preparing nourishing articles of food for the sick, with milk, eggs, etc.

MARRUBIUM.—Marrubium (Hoarhound).

Pharmacology.—"The leaves and tops of Marrubium vulgare (Labiatæ)," a small herb of Europe and America; contains a bitter principle, **Marrubiin**, with a peculiar **volatile oil**, resin, tannin, etc. It is best given as fluid extract (dose, 4 to 7.5 c.cm., or f3i-ij).

Therapy.—Hoarhound is employed as a bitter tonic and stomachic, and as an expectorant, diaphoretic, laxative, and diuretic. It is popular in confectionary as cough-drops, used for sore throat, cough, and catarrhal conditions of the air-passages. When a diaphoretic effect is desired, the herb may be used in infusion (31 Gm. to 473 c.cm., or ℥j to Oj), taken hot in recent colds. The cold decoction is serviceable in chronic pulmonary affections.

MASTICHE (U. S. P.).—**Mastic.**

Preparation.

Pilulæ Aloes et Mastiches (U. S. P.).—Pills of Aloes and Mastic (purified aloes, 13 Gm.; mastic, 4 Gm.; red rose, 3 Gm.; water, q. s. to make 100 pills).

Pharmacology.—"A concrete, resinous exudation from Pistachia Lentiscus (Anacardiaceæ)," consisting of **Mastichic acid** (90 per cent.), soluble in alcohol, and another resin, **Mastichin**, soluble in ether. It enters into the U. S. P. official pills of aloes and mastic, and has no other application at present in medicine, except that it may be used as a temporary filling for decayed teeth, the ethereal solution being used to saturate a small plug of absorbent cotton, which is pressed into the cavity. Mastic is also used in making cements and varnishes.

MATICO (U. S. P.).—**Matico.**

Dose, 2 to 4 Gm. (or gr. xxx-℥j).

Preparations.

Fluidextractum Matico (U. S. P.).—Fluid Extract of Matico. Dose, 1.20 to 7.5 c.cm. (or *m*xx-f3ij).

Pharmacology.—"The dried leaves of Piper angustifolium (Piperaceæ)," of South America, contain volatile oil ($1^1/_2$ per cent.); a soft, green, pungent **resin**; a bitter principle termed **Maticin**, **Artanthic acid**, and **tannin**. The odor is aromatic and the taste astringent.

Therapy.—Powdered matico acts as a mechanical hæmostatic, the roughness of the leaves favoring clotting of the blood when dusted over the bleeding surface. Internally the fluid extract is used in inflammations and catarrhal affections of the urinary organs, as chronic cystitis, leucorrhœa, incontinence of urine, and menorrhagia. In hæmorrhages from the stomach, bowels, and kidneys, and even from the lungs, it has also been employed, as well as in diarrhœa and dysentery. The use of matico sometimes produces erythema.

MATRICARIA (U. S. P.).—**Matricaria (German Chamomile).**

Dose, 4 to 12 Gm. (or f3i-iij), in infusion or fluid extract.

Pharmacology.—"The flower-heads of Matricaria chamomilla (Compositæ)" are official under this name. It is a European annual, bearing small, yellow flowers, with white ray-florets; receptacle conical, naked, and hollow. The odor of the plant is due to a blue volatile oil existing in the

flower-heads, together with bitter extractive, tannin, etc. The blue coloring matter in the oil is a volatile principle called **Azulene** or **Cœrulein.** From the volatile oil are slowly deposited crystals of matico camphor ($C_{17}H_{20}O$), which is the most active constituent.

Physiological Action and Therapy.—A decoction, drunk as hot as possible, is a remedy for colds as a diaphoretic; in large doses it acts as an emetic. The cold infusion can be used in smaller quantities as a tonic and stomachic. It is highly prized among the common people in Germany in domestic practice for the relief of colds, rheumatism, dysmenorrhœa, etc., given in the form of tea. It is also considered antispasmodic and anthelmintic. It is used for the same purposes generally as anthemis, or chamomile.

MAYS.—Maize, Indian Corn. The maize, Zea mays (Gramineæ), is a cereal of North America, largely cultivated for food. The fruit, or Indian corn, Maidis fructus, contains: starch, 65 per cent.; nitrogenized substances, 8 to 10 per cent.; with a yellow, fixed oil, sugar, cellulose, and water. Green corn, boiled, is a highly-prized summer vegetable. There are many varieties, but the principal ones are yellow corn and white corn. When ground they afford cornmeal (Maidis farina). Cornmeal is also used for food, as bread, cakes, etc., and, with boiling water, makes a mush, or "hasty-pudding." The hot, boiled mush also makes a good poultice, as it retains heat well. Cornstarch (Maidis amylum), made from the ripe corn in the same manner as wheatstarch is prepared, is also an acceptable article of food, used for making puddings, *blanc-mange*, etc. It is in the form of a white, impalpable powder, which can be utilized as a substitute for lycopodium, as a dusting-powder for pills and troches, and for excoriated surfaces, or as a baby-powder. (See also **Maidis Stigmata.**)

MEL (U. S. P., B. P.).—**Honey.**

Preparations.

Mel Rosæ (U. S. P.).—Honey of Rose.

Confectio Rosæ (U. S. P.).—Confection of Rose (red rose, 8 Gm.; sugar, 64 Gm.; clarified honey, 12 Gm.; stronger rose-water, 16 c.cm.).

Mel Depuratum (U. S. P., B. P.).—Clarified Honey.

Mel Boracis (B. P.).—Borax Honey (borax, 50; glycerin, 25; clarified honey, 400 Gm.).

Oxymel (B. P.).—Oxymel (clarified honey, 8; acetic acid, 1; distilled water, 1 c.cm.). Dose, 4 to 7.5 c.cm. (or f3i-ij).

Pharmacology.—Honey is "a saccharine secretion deposited in the honey-comb by the hive bee, Apis mellifica (class, Insecta; order, Hymenoptera)." Virgin honey is that obtained from recent combs by incision and straining; when heat is used to separate the comb the product is of a darker color, and there is a loss of flavor. What is known as clarified honey is prepared by heating honey on a water-bath, removing the frothy scum which rises, and straining. The flavor of honey is dependent upon the time of the season and the character of the flowers that furnish the saccharine material. It is believed that, at times, poisonous principles have been taken by bees from narcotic plants, and, consequently, the character of the honey has been affected injuriously. The constituents of honey are fruit-sugar, which remains always liquid, and glucose, which tends to crystallize and thicken the

honey. Much of the honey used for household purposes has glucose fraudulently added, or it may be entirely an imitation honey.

Physiological Action.—Honey is slightly laxative, and a pleasant, sweet article of food. It is a good excipient for pill-masses.

Therapy.—The old mixture of borax and honey, official in the British Pharmacopœia, for the treatment for babies' sore mouth is now rarely used, as the honey favors fermentation, and, besides, adds nothing therapeutically to the mixture, for the borax acts better without it. In glycosuria, the use of honey usually increases the quantity of sugar voided, and it has been used, therefore, to aid in the diagnosis of diabetes. In sore throat, mel rosæ may be used as an application, in combination with astringents. A spoonful of honey made into a paste with an equal quantity of ryemeal and thickly spread upon the inflamed surface is claimed by Ziem to be a good domestic application to par-auricular abscesses. Oxymel is a pleasant addition to gargles or it may be used as a vehicle for astringents or expectorants, in doses of 4 to 7.5 c.cm. (or f℥i-ij).

MELISSA.—Melissa (Balm).

Pharmacology.—"The leaves and tops of Melissa officinalis (Labiatæ)," a small herb growing in Europe and in the United States. It contains gum, tannin, bitter extractive, and volatile oil. The odor of the plant is fragrant, and it has an aromatic, slightly-bitter taste; the bruised leaves have a lemon-like odor.

Physiological Action and Therapy.—Melissa is carminative, and may be used in infusion, medicated water (distilled), or as a fluid extract, the dose of the latter being 4 to 7.5 c.cm. (or f℥i-ij). The compound spirit of melissa, or Carmelite spirit, is a cordial containing a number of spices, which make it a stomachic and corrective of flatulence.

MENISPERMUM.—Menispermum (Yellow Parilla, Canadian Moonseed).

Dose, 0.32 to 1.30 Gm. (or gr. v-xx), in infusion.

Preparation.

Fluidextractum Menispermi.—Fluid Extract of Menispermum. Dose, 2 to 4 c.cm. (or f℥ss-j).

Pharmacology.—The rhizome and roots of Menispermum Canadense (Menispermaceæ), a plant growing in the eastern United States. The rhizome may be several feet in length; it contains **Berberine**, also a white alkaloid, soluble in alcohol and ether, sparingly soluble in water, which was isolated by H. L. Barber.

Therapy.—Moonseed, or yellow parilla, is believed to resemble sarsaparilla in possessing diuretic, tonic, and alterative powers, and is also a laxative. In domestic practice it is used to purify the blood in scrofulous affections. It has no very well marked therapeutic properties.

MENTHA PIPERITA (U. S. P.).—**Peppermint.**

The dried leaves and flowering tops of Mentha piperita (Labiatæ).

Preparations of Peppermint.

Aqua Menthæ Piperitæ (U. S. P., B. P.).—Peppermint-water. Dose, 4 to 60 c.cm. (or f℥i-f℥ij).

Oleum Menthæ Piperitæ (U. S. P., B. P.).—Oil of Peppermint. Dose, 0.06 to 0.30 c.cm. (or *m*i-v).

Spiritus Menthæ Piperitæ (U. S. P., B. P.).—Spirit of Peppermint. Dose, 0.60 to 4 c.cm. (or *m*x-f3j).

Menthol (U. S. P., B. P.).—Peppermint-camphor (a crystalline solid). Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Also enters into compound pills of rhubarb (U. S. P., B. P.).

MENTHA VIRIDIS (U. S. P.).—**Spearmint.**

The dried leaves and flowering tops of Mentha viridis (Labiatæ).

Preparations of Spearmint.

Spiritus Menthæ Viridis (U. S. P.).—Spirit of Spearmint. Dose, 0.30 to 1.20 c.cm. (or *m*v-xx).

Aqua Menthæ Viridis (U. S. P., B. P.).—Spearmint-water. Dose, 4 to 60 c.cm. (or f3i-f3ij).

Oleum Menthæ Viridis (U. S. P., B. P.).—Oil of Spearmint. Dose, 0.12 to 0.30 c.cm. (or *m*ii-v).

Pharmacology.—The leaves and tops of both the Mentha piperita and the Mentha viridis, of the natural order Labiatæ, are indigenous to Great Britain, but are naturalized in the United States and many other countries. Each variety owes its properties to a volatile oil, from 1 to 1 $^1/_4$ per cent. being present, with some tannin, in peppermint. The British Pharmacopœia directs that the oil of peppermint be distilled from the fresh flowering peppermint, Mentha piperita, and the oil of spearmint from the fresh flowering spearmint, Mentha viridis. Menthol, which is the stearopten or camphor of peppermint-oil, is deposited, on cooling, from the oil of the fresh herb Mentha arvensis and Mentha piperita. It smells and tastes like peppermint, is soluble in alcohol, ether, and the fixed and volatile oils, but slightly soluble in water. Menthol occurs in the form of colorless crystals or fused crystalline masses, and resembles Epsom salt in appearance. It is quite volatile, and melts at 108° to 110° F.

Physiological Action.—Peppermint, especially the oil, locally has an anodyne, anæsthetic, and antiseptic action. Its taste is rather pleasant and pungent, and it acts as a carminative and stimulant in the stomach, especially in the form of the spirit; the troches are also used for this purpose as well as to disguise a bad breath. Spearmint corresponds, in its effects, with peppermint, but is less powerful and less agreeable.

The taste of menthol is sharp and penetrating. When placed upon the skin it gives rise at first to a burning sensation, which is succeeded by one of coolness, and finally by numbness or analgesia. It has decided antiseptic power, being comparable in this respect to thymol.

Therapy.—In neuralgia, oil of peppermint may be painted over the painful spot or along the course of the nerve. If the oil is employed, evaporation should be prevented by covering the painted surface with oiled silk. It may also be used for myalgia and many local pains, commonly called rheumatic, and is often of service in chronic gout. In flatulent colic, the spirit of peppermint in hot water is a good household remedy, particularly applicable to children. The oil of peppermint allays nausea, and is serviceable in disguising the taste of unpalatable drugs. Peppermint is a good addition to purgative remedies, as in the compound rhubarb pill, to prevent griping. In pruritus pudendi, peppermint-water is a good application, with 4 to 8 Gm. (or 3i-ij) of borax to each pint.

In a number of cases of pulmonary tuberculosis, improvement has followed the inhalation of oil of peppermint, vaporized by means of hot water. It is stated that cough, fever, and night-sweats were all relieved.

Menthol has been employed almost exclusively as a topical remedy, though it has been given internally in the dose of 0.32 Gm. (or gr. v) for the relief of neuralgia. It is also recommended as an intestinal antiseptic in the dose of 0.10 Gm. (or gr. iss), given in a capsule with oil of sweet almond, six to eight being taken daily. In this way, it is very efficient against the hook-worm, **uncinariasis.**

Its principal usefulness is in the alleviation of itching and pain. It may be applied in the form of a solid pencil or cone, an alcoholic solution, or an ointment. It has also been administered by inhalation in hay fever and diphtheria. In the nasal form of hay fever, a mixture of menthol and ammonium carbonate makes a very efficient smelling-salt. In neuralgia (especially when it involves a superficial nerve), in herpes zoster, and dermatalgia, a lotion or ointment containing menthol is capable of affording considerable relief. The pain of a carious tooth may be alleviated or removed by placing a menthol solution within the cavity, or menthol dissolved in 15 parts of oil of cloves. The itching of paræsthesia, eczema, and urticaria may often be alleviated by the same remedy.

By spraying with a benzoinol solution of menthol, Dr. Elizabeth N. Bradley was able to reduce an acute hæmorrhoidal prolapse which came on during a severe attack of epidemic influenza and which had resisted the action of other remedies. The use of the spray was almost immediately followed by cessation of pain and diminution in the size of the tumors.

Inhalations of menthol have also been successfully resorted to in asthma. It is readily volatilized in a tea-pot by the addition of hot water. The tea-pot being closed, the vapor is inhaled as it issues from the spout. Ointments and lotions of menthol may be compounded as follows:—

℞ Phenolis liq.	2	Gm.	or 3ss.
Menthol.	1 30	Gm.	or gr. xx.
Ungt. aquæ rosæ	31	Gm.	or ℥j.—M.

M. Sig.: For paræsthesia, urticaria, and herpes zoster.

℞ Tinct. belladonnæ fol.,			
Tinct. aconiti	aa 6	c.cm.	or f℥iss.
Menthol.	2	Gm.	or 3ss.
Alcoholis	60	c.cm.	or f℥ij.
Glycerini,			
Aquæ rosæ	aa 15	c.cm.	or f℥ss.

M. Sig.: Use as a local application in dermatalgia, herpes zoster, and neuralgia.

Dr. Leonard A. Dessar publishes the following formula for an antiseptic snuff-powder:—

℞ Menthol.	10 parts.
Acid. tannic.	2 parts.
Acid. boric.	30 parts.
Bismuth. subnit.	20 parts.
Amyli	50 parts.
Cocainæ hydrochlor.,	
Aristol.	aa 0.5 part.

M. Sig.: Make a fine powder.

Dr. Wolf[1] recommends menthol rubbed up with sugar (5 to 10 per cent.) applied with a large camel's-hair brush, as a local disinfectant in diphtheria, used early in the disease. He advises applications to be made several times in the day, removing as much as possible of the membrane at a time. Kastorsky prefers a 10-per-cent. alcoholic solution, applied thrice daily by means of a piece of cotton-wool. The same method is beneficial in the sore throat of scarlatina and in catarrhal pharyngitis. A 10- to 50-per-cent. ethereal solution of menthol, applied two or three times a day by means of a camel's-hair pencil, is of service in aborting cutaneous abscesses, boils, carbuncles, etc. In laryngeal and tracheal phthisis, and in the laryngeal ulcerations occurring during the course of pulmonary tuberculosis, Rösenberg uses a 20-per-cent. solution of menthol in olive-oil, introduced with a syringe or a spray into the larynx; two or three injections of 1 c.cm. (or *m*xv) each are made at the affected spot, followed by inhalations of the same from boiling water, or a respirator can be used. The relief from dyspnœa is very great. Corresponding results have been obtained in pulmonary tuberculosis by the daily application through the trachea in doses of 4 c.cm. (or f3j) of a 12-per-cent. solution of menthol in sterilized olive-oil.

In bronchiectasis, the injection into the trachea, twice daily of 4 c.cm. (or f3j) of the following mixture, as recommended by Dr. T. G. Stewart, was followed by speedy improvement:—

℞ Menthol ..... 10 parts.
Guaiacol ..... 2 parts.
Olive-oil ..... 88 parts.—M.

Dr. A. L. Benedict, of Buffalo, states that in a number of cases of atonic dyspepsia he has derived advantage from the application of the menthol-spray to the walls of the stomach through the stomach-tube. The organ is first washed out and a 1- to 5-per-cent. solution of menthol in liquid petrolatum is blown through the tube. An instrument has been especially designed for this method by Dr. Fenton B. Turck, of Chicago.

In affections of the middle ear, especially when the mucous membrane is much swollen, Dr. Joseph Bronner has derived benefit from inflating the cavity with menthol-vapor. A few drops of a 20-per-cent. solution of menthol in olive-oil, contained in an antiseptic capsule attached to the Eustachian catheter, are slowly vaporized and inflated by Lucæ's modification of the Politzer bag. It is important that the use of the vapor should be prolonged and the procedure is said to excite no pain or inflammation. Dr. Cholewa, of Berlin, states that menthol will usually arrest the course of furuncle and suppuration of the ear. It controls diffuse inflammations of the auditory canal and has occasioned marked improvement in cases where the mastoid was involved and in which it seemed that operative procedures would be demanded. He made use of a 10- to 15-per-cent. oily solution.

MERCUROL.—The nucleinate of mercury was employed by Ayres, of New York, in the treatment of syphilis. It is a soluble powder, containing 10 per cent. of mercury. A 2-per-cent. solution is useful as a dressing for ulcers, and as an injection in gonorrhœa. A 5-per-cent. solution is recommended for trachoma. Internally, it is given in capsules, in doses of 0.04 to 0.10 Gm. (or gr. $^3/_4$ to $1^1/_2$).

[1] *Therapeutische Monatshefte*, Sept., 1890.

METHYLAL. — Methylene-dimethyl-ether. Methylal is obtained by the action of a mixture of sulphuric acid and manganese dioxide upon methylic alcohol. It is a colorless fluid, boils at 107.6° F., and is soluble in water, alcohol, ether, fatty and ethereal oils. Methylal reduces arterial pressure and has an hypnotic effect. It is rapidly eliminated. It has been used in insomnia, but a tolerance is soon established and the remedy loses its influence unless given in constantly-increasing doses. Methylal has been given with some success in asthma and intestinal colic. Methylal has also been employed in order to allay the excitement of delirium tremens. For the purpose of producing local anæsthesia in dentistry methylal has been mixed with 4 parts of tincture of coca. One part by weight of methylal and 6 parts of almond-oil have been recommended as a liniment. Dose, 4 to 7.5 c.cm. (or f℥i-ij).

METHYL CHLORIDE.—Methyl chloride is a gas (chlormethyl, monochlormethane) produced by the reaction between methyl alcohol and hydrochloric acid in the presence of zinc chloride. It is free from color and possesses an ethereal odor; is soluble in water, alcohol, ether, and chloroform. It becomes liquid under the pressure of five atmospheres at ordinary temperatures. A spray of the liquid directed from the distance of about a half a yard from the affected surfaces produces a freezing effect. The application acts as an anodyne, and is beneficial in various forms of neuralgia, chronic rheumatism, and other painful conditions. The liquid methyl chloride is supplied in small glass tubes, from which the spray issues in a fine jet. These are used to produce local anæsthesia for small surgical operations.

METHYLENI BICHLORIDUM.—Methylene bichloride is a colorless fluid having an odor resembling that of chloroform. It is prepared by reducing an alcoholic solution of chloroform by zinc and hydrochloric acid. A mixture of pure methylene chloride and ether was introduced by Sir Benjamin Ward Richardson as a general anæsthetic, but has not been extensively used for that purpose and is not free from danger. The English methylene chloride, or methylene, is of variable composition, and probably its virtues depend upon the presence of chloroform. Richardson has also used it as an internal remedy in doses of 0.30 to 2 c.cm. (or *m*v-xxx), and states that it possesses antiseptic, stimulant, antispasmodic, and anodyne properties. He praises its action in typhoid fever combined with hydrogen dioxide, and in acute rheumatism associated with sodium salicylate.

METHYLTHIONINÆ HYDROCHLORIDUM (U. S. P.).—**Methylene-blue.** Methylene-blue communicates a blue color to the urine and fæces. Large doses will sometimes cause a scalding sensation in the bladder. It has an inhibitory influence upon various microbes. P. Ehrlich observed that the plasmodium of malaria and the red blood-corpuscles are strongly influenced by this dye. According to the observation of Rosin, it arrests the movements of the malarial parasites. As the methylene-blue usually sold as a dye contains zinc chloride, it is important that, for therapeutic administration, a chemically-pure article should be obtained.

Therapy.—Solutions of methylene-blue have been locally applied with advantage in vaginitis, and to fistulous tracts. Methylene-blue has been found of service in malarial fevers by Guttmann, Ehrlich, Thayer, and others,

though whether it is able to prevent recurrence has not yet been demonstrated. Although it has a decided action in malarial fever, it cannot be regarded as possessing any special advantage over quinine.

Methylene-blue has been serviceable, also, in trigeminal neuralgia, migraine, herpes zoster, and muscular rheumatism. In neuralgia it may be given in daily amount of 1 Gm. (or gr. xv) without producing any ill effects.

Netschajeff, of Moscow, has derived good results from the use of this remedy in acute nephritis. He administered 0.10 Gm. (or gr. iss) thrice on alternate days. The quantity of urine was increased, albumin and casts were diminished, and œdema rapidly vanished. Methylene-blue is of service in diphtheria, being administered internally and applied topically in watery 1 to 9 solution. Clinical experiments have been made with methylene-blue in the treatment of tuberculosis. It reduces the temperature and in most cases diminishes night-sweats. It may serve a good purpose in the early stage of the disease, but in advanced cases has no effect upon cough, expectoration, or diarrhœa. Professor d'Ambrosio, of Naples, observed a remarkable improvement in a case of ulcerated mammary carcinoma from daily injections into the tumor of 1 c.cm. (or *m*xv) of a 1-per-cent. solution. Pain and hæmorrhage ceased and the tumor underwent retrocession. A. Darier, of Paris, has cured superficial epitheliomata by painting them with a solution containing 1 Gm. (or gr. xv) of methylene-blue dissolved in 5 c.cm. (or f℥i $^1/_4$) each of alcohol and glycerin. All of the portion stained is then touched with a steel probe which has been dipped in a 1 to 5 solution of chromic acid. Crusts should be removed before the application is made.

Kahane, of Vienna, urges a trial in primary syphilis of:—

℞ Quininæ sulphatis,
Methylthioninæ hydrochloridi.....aa 6| Gm. or ℥iss.
Arsenii trioxidi..... 0|003 Gm. or gr. $^3/_{64}$.
Ext. glycyrrhizæ..... q.s.
Ft. pil. no. xxx. Take one pill three times daily.

The internal exhibition of methylene-blue in gonorrhœa seemed to produce a decided effect upon the discharge. It has also been used with asserted advantage in this disease as an injection, a 1 to 200 or 1 to 250 solution being used from ten to fifteen times a day. D'Aulnay reports good results from packing the vagina with a tampon saturated in a solution composed of 10 Gm. (or ℥iiss) of methylene-blue, 15 c.cm. (or f℥ss) of alcohol, and 0.20 Gm. (or gr. iij) of potassium in 210 c.cm. (or f℥vij) of water. It has been proposed to take advantage of the green color which this substance communicates to the urine by adding it to medicines given to hypochondriacs and malingerers, in order to detect deception as regards taking the medicine. Excellent results in eleven cases of beriberi from the use of mthylene-blue are reported by Professor Thur. The internal administration of the remedy is also apparently of some service in carcinoma.

METHYLIS SALICYLAS (U. S. P.).—**Methyl Salicylate.** An ester produced synthetically. It is the principal constituent of oil of gaultheria and oil of betula. For flavoring purposes it may be regarded as identical with them. Formula, $CH_3C_7H_5O_3$. For use see **Gaultheria.**

METHYL-VIOLET.—Pyoktanin (pus-destroyer) is a descriptive name applied to methyl-violet: an aniline dye which occurs in the form of a paste and in crystals. Chemically it is penta- and hexa- methyl-para-rosaniline

hydrochloride, but is rather variable in composition. It has been employed in the form of powder, pencil, and solution. The paste can be readily molded into pencils. The powder is made by mixing 2 parts of methyl-violet, or pyoktanin, with 98 parts of talc or other inert material. The solution may be made of any strength, from 1 part in 100 to 1 in 2000. It is also used in the form of an ointment containing from 2 to 10 per cent. The same title is given to another variety, yellow aniline, chemically pure and free from arsenic. The latter is used in ophthalmic practice; the former in general surgery.

Physiological Action.—Methyl-violet is an efficient germicide. According to the laboratory experiments of Fessler, the micro-organisms of pus are destroyed in fifteen minutes by exposure to a 1 to 1000 solution of pyoktanin. This conclusion, however, is contradicted by Trojé, who found that, although the development of germs was inhibited by pyoktanin, yet even after subjection to its action for twelve hours the pus-germs were not certainly destroyed. The latter writer, therefore, asserts that pyoktanin is less powerful than carbolic acid or mercuric chloride. Pyoktanin does not coagulate albumin. A solution of this substance dropped into the eye is said to cause dilation of the pupil without paralysis of accommodation.

Methyl-violet, when administered internally, is rapidly absorbed, and soon makes its appearance in the urine, giving a blue color to that fluid. The urine of patients who have taken 0.20 Gm. (or gr. iij) two or three times a day will remain aseptic for three weeks. This dose may cause intermission of the pulse. Pyoktanin is irritant to the kidney and is capable of exciting an acute nephritis. Combemale found that a dose of methyl-violet equal to 0.13 Gm. (or gr. ij) to the pound of body-weight was fatal to guinea-pigs. The blood exhibited a chocolate discoloration, the heart was flaccid, and the liver and mesenteric vessels were engorged.

Therapy.—Pyoktanin has been employed almost exclusively as a topical medicament, though Ehrlich and Leppmann state that, given hypodermically, it relieves neuralgia and rheumatic pains. The diluted powder, the solution, and the pencil of pyoktanin, from the writer's experience, disinfect suppurating or ulcerated wounds, stimulate reparative action in chronic ulcers, and form excellent applications to chancroids, open buboes, gummous ulcers, boils, and carbuncles. Unna uses as a dressing to chancroids a mixture composed of:—

℞ Pyoktanin,			
Potassii bicarb.	aa	1	Gm. or gr. xv.
Aquæ destill.		90	c.cm. or f℥iij.
Alcohol.		18|5	c.cm. or f℥v.
Reduce by heat to three ounces and add:—			
Pyoktanin,			
Sodii borat.	aa	1	Gm. or gr. xv.
Aquæ destill.		90	c.cm. or f℥iij.—M.

Good results have been reported in gonorrhœa from the injection of weak solutions. In some cases of chronic cystitis the injection of a 1 to 1000 or a 1 to 500 solution has been found markedly beneficial. As a dusting-powder, it has been used upon moist eczema.

Stilling, in his original paper, laid great stress upon the value of this agent in affections of the eye, especially corneal ulcers, parenchymatous keratitis, and serous iritis. These assertions have not been generally con-

firmed. In the experience of most ophthalmologists, pyoktanin is by no means superior, if even equal, to corrosive sublimate. It is conceded, however, that pyoktanin acts as a mild, local anæsthetic. In conjunctivitis, dacryocystitis, etc., pyoktanin is best employed in the form of a solution. In chronic ophthalmia, trachoma, and fistulous openings into the lacrymal sac the pencils of the drug are preferable to use.

In otology[1] testimony as to its value is conflicting. While in some cases its use was attended with excellent results in purulent inflammation of the middle ear, furuncle of the external meatus, or after removal of a polypus from the meatus, in other cases of otitis pyoktanin proved a failure.

A persistent case of ptyalism was cured by Heitmann by the local application twice daily to the whole of the oral cavity of a 0.1-per-cent. solution of pyoktanin. It has also been employed with good results in diphtheria by Dr. C. Höring. He applies a 3-per-cent. solution two or three times a day to the affected parts, and finds it destructive to the false membranes. It diminishes pain and fever without giving rise to toxic symptoms. Dr. Höring states that he has in this manner treated 112 undoubted cases of diphtheria, 110 of which recovered. In nasal diphtheria he introduced within the cavity and kept in position a tampon saturated in the solution.

Methyl-violet has been used as an internal remedy with asserted advantage in acute gonorrhœa, acute and chronic Bright's disease, herpes zoster, and senile paræsthesia. The doses employed in these cases generally ranged from 0.03 to 0.23 Gm. (or gr. ss-iiiss) three times a day. In acute nephritis it is said quickly to quadruple the quantity of urine passed and cause the disappearance of casts, œdema, cardiac and pulmonary symptoms.

Solutions of pyoktanin have been injected into pulmonary cavities with the result of reducing temperature and causing bacilli to disappear from the sputum. A report in reference to the treatment of tuberculosis by this method has been made by Petterutti and Mirto. These writers state that injections of a 1 to 500 solution of pyoktanin directly into a cavity are well borne, produce no reaction, reduce temperature, and cause disappearance of bacilli from the sputum. The remedy has a deleterious effect upon the bronchi if brought in contact with the mucous membranes, and may also exert an injurious influence upon the kidney.

The absence of odor is one feature which makes this substance preferable to iodoform. On the other hand, methyl-violet communicates a deep-purple color to the skin or linen with which it comes in contact. This stain may be removed, however, by dilute hydrochloric or nitric acid, or alcohol.

METHYSTICUM.—Kava. The dried root of Macropiper latifolium (Piperaceæ). (See **Kava-kava.**)

MEZEREUM (U. S. P.).—**Mezereum.**

MEZEREI CORTEX (B. P.).—**Mezereon-bark.**

Preparations.

Fluidextractum Mezerei (U. S. P.).—Fluid Extract of Mezereon. Used only as an irritant.

It is also a constituent of:—

Decoctum Sarsaparillæ Compositum.—Compound Decoction of Sarsaparilla.

[1] See paper on "Experiences with Pyoktanin in Ophthalmological and Otological Practice," by Adolf Alt, M.D., *St. Louis Courier of Medicine*, Jan., 1891.

Fluidextractum Sarsaparillæ Compositum (U. S. P.).—Compound Fluid Extract of Sarsaparilla.

Pharmacology.—Mezereon is "the dried bark of Daphne Mezereum (Thymelæaceæ), and of other European species of Daphne" (U. S. P.); "the dried bark of Daphne Mezereum, or of Daphne Laureola, or of Daphne Gnidium" (B. P.), growing in Europe and Asia in mountainous regions. It contains **Daphnin,** a bitter glucoside in colorless crystals, sparingly soluble in cold solvents; an acrid, rubefacient, **volatile oil,** and a soft, brown, acrid **resin,** which is the anhydride of **Mezereinic acid.** Mezereum is an ingredient in the compound decoction and compound syrup of sarsaparilla (U. S. P.), and the extract enters into the compound mustard liniment (U. S. P.). (See **Sinapis.**) Unguentum Mezerei (not official), Ointment of Mezereon, contains fluid extract of mezereon, 25; lard, 80; yellow wax, 12 parts, the alcohol of the extract being entirely evaporated by heat. It is used as a counter-irritant and to prolong the discharge from blistered surfaces.

Physiological Action.—The powdered bark is irritating to the skin, and, when fresh, causes vesication; it excites violent sneezing when inhaled into the nostrils. In small doses internally it is sialagogue, laxative, and diuretic, and is considered tonic and alterative. In large doses it is a violent, irritant poison, causing vomiting, purging, and inflammation of the stomach and intestines. Nephritis is said to follow its tonic administration. The treatment would be eliminative and symptomatic. Demulcent drinks, starch-water, etc., may be freely swallowed, and hypodermic injections of morphine given. The ointment is used as irritant to keep up discharges from ulcers and blistered surfaces.

Therapy.—The use of mezereum in medicine is restricted to its external application in the form of an irritant ointment, as first mentioned, and its combination with sarsaparilla and other remedies in the forms above referred to, as an alterative in syphilis and chronic rheumatism, associated with potassium iodide.

℞ Potassii iodidi ..... 8| Gm. or ʒij.
Syr. sarsaparillæ co.,
Aquæ ..... aa 90| c.cm. or fʒiij.

M. Sig.: A tablespoonful two hours after meals for syphilis, rheumatism, and skin diseases.

Mezereum has also been successfully used to relieve toothache, and as a masticatory in paralysis of the tongue.

MITCHELLA.—Squaw-vine, Checker-berry, Winter-clover, Partridge-berry. The whole plant of Mitchella repens (Rubiaceæ) is used in making the infusion and fluid extract. It is a small, creeping, evergreen herb, with red berries appearing in the autumn, which may remain until spring. The leaves and berries have a flavor like that of gaultheria; they apparently contain a small amount of **Saponin.**

Physiological Action.—The preparations of Mitchella are said to be astringent, diuretic, and parturifacient; they are also supposed to favor the occurrence of menstruation.

Therapy.—In dropsy and suppression of urine the infusion is given,

and also in dysmenorrhœa, menorrhagia, etc. Its name of "squaw-vine" was gained from its use by the Indians, who administered the infusion to women for several weeks before the expected occurrence of parturition in order to facilitate delivery.

MONESIA.—The bark of Chrysophyllum glycyphlæum (Sapotaceæ), a tree of Brazil and other varieties of the same species, contains, according to Henry and Payen, **Saponin**, an allied body termed **Monesin**, tannic acid, glycyrrhizin, wax, a crystalline fatty substance, etc.

Physiological Action and Therapy. — Monesia possesses expectorant properties free from unpleasant effects, and, by virtue of the tannin which it contains, is astringent. Small doses of monesia improve the appetite. Large amounts disturb the stomach and cause constipation. Formerly employed in medicine, monesia had fallen into disuse, but has been studied anew by Dr. P. G. Rozanoff, of Moscow. It was found of benefit in acute and chronic bronchitis, pneumonia, subacute enteritis, and diarrhœa, given in a mixture of 2 to 4 Gm. (or ʒss-j) of aqueous extract of the bark to 180 c.cm. (or fʒvj) of water, a tablespoonful dose every second hour. Monesia was particularly valuable in co-existent catarrhal states of the respiratory and intestinal tracts. It is said to possess virtue as a tæniacide. A decoction containing 62 Gm. (or ʒij) each of monesia and pomegranate-bark will usually prove an efficient combination. Monesia has also been given with asserted advantage in dyspepsia, scurvy, scrofula, hæmoptysis, and menorrhagia. In the form of powder or ointment it has been applied to indolent or unhealthy ulcers. An extract is given in doses of 0.13 to 0.65 Gm. (or gr. ii-x); it may also be administered in aqueous solution, syrup, or tincture. Monesin has been applied to ulcers, and has been used internally in the dose of 0.032 Gm. (or gr. ss). Monesin is said to possess oxytocic virtue.

MORPHINA (U. S. P.). (See **Opium.**)

MORRENIA.—Morrenia brachystephana (Asclepiadaceæ), a plant growing in the Argentine Republic and other South-American countries, contains, according to the analyses of Señor Pedro N. Arata, a fatty acid, resins, salts of lime, a glucoside, starch, albumin, gum, and a small quantity of a substance giving alkaloidal reactions. The alkaloid was obtained as a dark-reddish mass, of pleasant odor and a very bitter taste, soluble in chloroform, water, and amylic alcohol.

Therapy.—The physiological action of the plant has not been studied, but it has long enjoyed a local reputation as a galactagogue, and Del Arca and Sicardo report favorably as regards its efficacy. From the leaves or root an infusion is prepared in the strength of 93 Gm. (or ʒiij) to 473 c.cm. (or Oj) of water, the dose being a tablespoonful.

MOSCHUS (U. S. P., B. P.).—**Musk.**

Dose, 0.32 to 0.50 Gm. (or gr. v-viij).

Preparation.

Tinctura Moschi (U. S. P.).—Tincture of Musk (5 per cent.). Dose, 2 to 4 c.cm. (or fʒss-j).

Pharmacology.—Musk is "the dried secretion from the preputial follicles of Moschus moschiferus (class, Mammalia; order, Ruminantia)" or musk-deer. The musk-sac is, in the living male animal, situated between the navel and the genitals, but nearer the latter, between the skin and the muscles of the abdomen. Musk in pods, or musk in the unopened sacs, is the only kind to be used in medicine, each sac containing from 4 to 8.40 Gm. (or gr. lx-cxxx) of actual musk. It is imported from China. Genuine Tonquin musk is composed of roundish, grains of irregular size, dark reddish brown, of a peculiar, penetrating, persistent odor and a bitter taste. It is partly soluble in water, and less so in strong alcohol; dilute alcohol dissolves about one-half. The odorous principle is probably a product of decomposition, constantly being formed; complete drying destroys it, but it returns again after moisture has been added. It is also destroyed by hydrocyanic acid and by camphor. Musk contains ammonia, fat, cholesterin, resinous matter, fatty acids, etc. It is largely used in perfumery, being very lasting and holding more evanescent perfumes with it. Musk in grains is much adulterated, or spurious. An artificial musk[1] has been produced, but quinine sulphate has the property of destroying its odor, while genuine musk is in no way affected by it.

Physiological Action. — Musk is a diffusible stimulant and antispasmodic. It creates a sensation of heat in the stomach, and in some persons excites nausea and vomiting. Headache and giddiness are also produced, with stimulation of the sexual appetite. A primary excitement of the central nervous system is succeeded by a more or less marked soporific effect. According to Brunton, musk appears to stimulate the respiratory centre. Artificial musk is reported to have little or no physiological or therapeutical effect, even when used subcutaneously.

Some cases having been reported of death from symptoms of malignant œdema after the subcutaneous injection of tincture of musk, Dr. J. Van Cott, Jr., examined various tinctures as well as the musk-sac itself for the presence of the bacilli of the disease. No bacilli were found in the tinctures, but in two cases infusions of the sacs yielded the organism which presumably had been attached to the skin removed with the sac.

Therapy.—Musk has been used in collapse of typhoid and other low fevers. Musk is valuable in the pneumonia of drunkards and in other cases of this disease occurring in debilitated subjects; also in hiccough, delirium tremens, and in convulsions of children. In many of the manifestations of hysteria—emotional crises, palpitation of the heart, vomiting, or spasm—this remedy is of value. The same may be said regarding other spasmodic affections, as chorea, whooping-cough, and laryngismus stridulus. It has been considered beneficial in melancholia and irregular gout. Its high price and the difficulty of obtaining an unadulterated article take it out of the ordinary range of remedies.

MUCUNA.—Mucuna, Cowhage. The hairs scraped from the pods of Mucuna pruriens (Leguminosæ), of the East and West Indies, were formerly used as a vermifuge, 4 to 8 Gm. (or 3i-ij) being mixed with molasses and administered to children suffering with round-worms. It causes irritation, simulating an erythematous or urticarial eruption when brought in contact with the skin. It is said that dishonest horse-dealers use cowhage to make

[1] "Artificial Musk," *Pacific Record*, Dec. 15, 1889.

horses appear more spirited, by applying it to anus, or genitals, just before exhibiting the animal for sale.

MUSCARINA.—Muscarina. (See **Agaricus Muscarius.**)

MYRICA.—Myrica, Bayberry-bark. The Myrica cerifera (Myricaceæ), a native of North America, contains in its bark a volatile oil and acrid resin.

Physiological Action.—Myrica is stimulant and astringent.

Therapy.—Externally, the infusion or diluted fluid extract of myrica may be used as a gargle or injection in various affections of the mucous membranes. It has also been employed in dysentery and diarrhœa.

MYRISTICA (U. S. P., B. P.).—**Nutmeg.**

Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Preparations.

Oleum Myristicæ (U. S. P., B. P.).—Oil of Nutmeg. Dose, 0.06 to 0.18 c.cm. (or *m*i-iij).

Spiritus Myristicæ (B. P.).—Spirit of Nutmeg. Dose, 2 to 4 c.cm. (or f3ss-j). B. P., 0.30 to 1.20 c.cm. (or *m*v-xx).

Also enters into Tinctura Lavandulæ Composita (U. S. P.), Pulvis Aromaticus (U. S. P.), Pulvis Cretæ Aromaticus (B. P.), and Pulvis Cretæ Aromaticus cum Opio (B. P.).

Pharmacology.—The nutmeg is "the kernel of the ripe seed of Myristica fragrans (Myristicaceæ)." The outer covering, or arillode, of the fruit was official in the United States Pharmacopœia under the name of **Macis,** or mace. The tree is a native of the East Indies, but grows also in the West Indies and in South America. The kernels of the seeds are round or elliptical in shape, about an inch in greater diameter and $^3/_4$ inch in smaller diameter. They are rather dense and heavy, and contain 2 to 8 per cent. of a volatile oil (which is official), and from 25 to 30 per cent. of fixed oil, usually known as oil of mace, with some resin. Nutmeg is fragrant, spicy, and somewhat bitter. It is useful in flavoring, and enters into a number of pharmaceutical preparations: aromatic spirit of ammonia, aromatic tincture of rhubarb, aromatic powder, compound tincture of lavender, troches of chalk, of magnesia, and of sodium bicarbonate, and also is a constituent in vinegar of opium.

Physiological Action.—With aromatic and carminative qualities, nutmeg unites considerable narcotic power, and in overdoses produces stupor and delirium. Dr. John Gillespie has reported a case[1] where five powdered nutmegs, taken to procure an abortion, had produced frontal headache, vertigo, free perspiration and urination, narcosis, and collapse. The treatment was an emetic of zinc sulphate (2 Gm., or gr. xxx), followed by small, repeated doses of aromatic spirit of ammonia. A similar case has been reported by Waugh.

Therapy.—The volatile oil of nutmeg is rubefacient, and may be used in rheumatism, neuralgia, and paralysis.

Nutmeg has been employed with advantage in itching and painful hæmorrhoids, according to the following formula:—

[1] *Philadelphia Medical Times,* vol. xvii, page 726.

℞ Pulv. myristicæ	8	Gm.	or 3ij.
Acid. tannic.	4	Gm.	or 3j.
Petrolati	31	Gm.	or ℥j.—M.

Internally, the powdered or grated nutmeg is employed as a carminative, anodyne, and astringent, to relieve sick stomach and for diarrhœa; it also allays colalgia and intestinal spasm. Garretson employed nutmeg for diarrhœa combined as follows:—

℞ Pulveris myristicæ,			
Bismuth. subnit. aa	15 | 5	Gm.	or ℥ss.
Cretæ præparatæ	5 | 2	Gm.	or gr. lxxx.
Syrup. zingiberis	90	c.cm.	or f℥iij.

M. Sig.: From a teaspoonful to a dessertspoonful every two hours.

Small doses favor digestion by stimulating the secretion of gastric juice. Nutmeg may be used to disguise the taste of unpalatable mixtures and to prevent the griping of a cathartic medicine.

The narcotic properties of nutmeg render it of avail in the treatment of delirium tremens. Mace acts similarly, but is used as a spice or condiment more than as a medicine. The expressed oil of nutmeg may be combined with wax and olive-oil, with heat, as ordered in the German Pharmacopœia, to form the myristicæ ceratum used as a warming application to the abdomen of babies suffering with colic or indigestion.

MYRRHA (U. S. P., B. P.).—**Myrrh.**
Dose, 0.13 to 2 Gm. (or gr. ii-xxx).

Preparations.

Tinctura Aloes et Myrrhæ (U. S. P.).—Tincture of Aloes and Myrrh (of each, 10 per cent.). Dose, 4 to 15 c.cm. (or f℥i-iv).

Tinctura Myrrhæ (U. S. P., B. P.).—Tincture of Myrrh (20 per cent.). Dose, 2 to 7.5 c.cm. (or f℥ss-ij).

Pilulæ Aloes et Myrrhæ (U. S. P., B. P.).—Pills of Aloes and Myrrh. Dose, 1 to 3.

It also enters into:—

Mistura Ferri Compositæ (U. S. P., B. P.). — Compound Iron Mixture. (See *Ferrum.*)

Pharmacology. — Myrrh is "a gum-resin obtained from Commiphora Myrrha (Burseraceæ)" (U. S. P.); "a gum resin obtained from the stem of Balsamodendron Myrrha, and probably from other species" (B. P.). It contains 60 per cent. of gum, 35 per cent. of **Myrrhin,** a resin, and about 2 per cent. of myrrhol, an ethereal oil; also some bitter principle. It forms an emulsion when rubbed up with water, which dissolves about 60 per cent. With alcohol it is partly soluble, forming a brownish-yellow tincture. Myrrh enters into several preparations besides those mentioned above, as the compound galbanum pills (B. P.) and compound rhubarb pills (U. S. P., B. P.).

Physiological Action. — Myrrh is slightly astringent and stimulant locally, and internally is carminative in small doses, but large ones cause vomiting and purging. It has some expectorant qualities, and is a stimulant to the ovarian and uterine functions.

Therapy.—Diffused in water, with the addition of a little carbolic acid or thymol, tincture of myrrh is a good mouth-wash for spongy gums, sore throat, or wounds after operations upon the mouth, or ptyalism occurring

after the use of mercury. It may be applied in the full strength to ulcerated gums, aphthous patches, relaxed uvula, and freckles. It is also used in dentifrices and to correct bad breath. A lotion or ointment containing myrrh is a stimulant and antiseptic dressing to indolent or unhealthy ulcers. An ointment made by heating together myrrh with wax and oils has been found useful in those cases of eczema which require moderate stimulation.

Favorable reports have been made of its action in atonic dyspepsia and gastralgia, though it has usually been prescribed in combination with other remedies. In amenorrhœa it is often given in conjunction with iron. Internally, myrrh is considered valuable in checking excessive discharges, bronchorrhœa, leucorrhœa, cystitis, etc. Under the name of myrrholin a concentrated solution of 1 part of myrrh in 1 part of oil has been given in tuberculosis conjoined with creosote in capsules. Myrrh has been used with reported success in diphtheria. It is given internally and applied locally to the pharynx. In laryngeal diphtheria the patient is made to inhale every hour or half-hour from 7.5 to 15 c.cm. (or f℥ii-iv) of a 2-per-cent. mixture of myrrh.

MYRTOL.—The Myrtus communis (Myrtaceæ) is a beautiful evergreen shrub or small tree, a native of the countries surrounding the Mediterranean. Its leaves and berries contain a volatile oil. According to E. Jahns, the myrtle-oil of Spanish origin contains various terpenes, cineol, and a camphor-like body, and the myrtol of commerce should more appropriately be termed rectified myrtle-oil. Myrtol is that portion of the oil of myrtle distilling between 160° and 170° C. (320° to 338° F.).

Physiological Action.—Myrtol is disinfectant and antiseptic. It causes no irritation when applied to the sound skin. Upon an abraded surface it gives rise to a slight burning sensation, which, however, soon disappears, and a 9-per-cent. emulsion of myrtol completely arrests the growth of the micro-organisms of pus. The decomposition of organic material is prevented by myrtol. Taken internally it promotes digestion. Large doses occasion nausea and headache. It is removed from the system by the lungs and kidneys, and communicates a violet-like odor to the breath and urine.

Therapy.—Externally, myrtol has been used with success as a disinfectant to surfaces covered with unhealthy, or decomposing, pus. It has proved efficacious in cutaneous diseases of vegetable parasitic origin, and has been recommended as a local remedy in psoriasis. Given internally, it has been found destructive to lumbricoid and thread- worms. Eichhorst advises its use in chronic bronchitis attended with profuse and fetid muco-purulent expectoration. The sputum becomes less abundant, less purulent, and less offensive. It diminishes fœtor in gangrene of the lung. In pulmonary tuberculosis it is said to decrease the number of bacilli. This remedy has also given relief in chronic pyelitis and cystitis, and has proved useful in passive hæmorrhage. Myrtol was introduced to the notice of the profession in 1878 by Dr. Linarix.[1] The extract of myrtle has been used by Dr. R. Weil, of Berlin, with reported benefit in diabetes mellitus. It was administered in doses of 0.13 Gm. (or gr. ij) thrice daily, increased every three days by three pills until fifteen were taken in the day. The remedy was well borne and caused diminution in the quantity of the sugar. Myrtol has been

[1] "De l'Emploi du Myrtol ou l'Essence de Myrte principalement dans les Maladies des Voies Respiratoires et Genito-Urinaires."

administered hypodermically, the solution used being 1 part of myrtol to 4 parts of liquid paraffin or oil of sweet almonds.

NAPHTHALENUM (U. S. P.).—**Naphthalene, Naphtalene** ($C_{10}H_8$). **Dose,** 0.065 to 0.65 Gm. (or gr. i-x).

Pharmacology.—Naphthalene is a "hydrocarbon obtained from coal-tar" and purified by distillation; comes in white crystals, which may be compressed into cakes like camphor, and having a peculiar, gas-house, or tarry, odor. It was discovered by Garden in 1820. Naphthalene is insoluble in water, but soluble in alcohol, ether, and chloroform. Being destructive to insect-life, it is employed as a substitute for camphor in preventing the invasion of moths.

Physiological Action.—Naphthalene may be prescribed internally as an intestinal antiseptic in doses of 0.13 to 0.65 Gm., or gr. ii-x (to children, 0.065 to 0.20 Gm., or gr. i-iij) every three or four hours. It may be given with white sugar in capsules or wafers. It has also decided expectorant powers, although its insolubility only permits a small quantity to be absorbed, which is discharged as naphthol or phenol by the bronchial mucous membrane or the urinary passages, thus acting as a local disinfectant at the point of excretion. It is devoid of local irritant properties. The urine assumes a dark color and may contain albumin. A morbilliform eruption, followed by desquamation, has been observed after the administration of naphthalene.

In the lower animals, one of the effects of naphthalene intoxication is cataract formation, this condition following the administration of 1 Gm. of naphthalene per kilogram of body weight.[1]

Naphthalene Poisoning.—Evers[2] records the case of chronic illness with loss of appetite, headache, and eczema over both legs, which was proved to be due to naphthalene poisoning. In this case the drug was used as moth-powder, and was sprinkled over some bedding. The symptoms subsided directly the patient was removed from this particular room, but reappeared when the same apartment was reinhabited. No other cause for the illness could be discovered. Evers had the naphthalene examined, and no impurity was detected. A case of typhoid is reported in which naphthalene was administered by Götze.[3] The patient was given 6 Gm. (or gr. xc) during the first three days; after this the dose was increased to 7 Gm. (or gr. cvij). On the evening of the sixth day the patient began to be restless, and on the following evening he was delirious. The next day the patient was drowsy; the respiration was labored and irregular. Lips and face cyanotic. Slight twitching in all the muscles of the body. Pulse regular, 92 per minute. The temperature had fallen to normal. The urine was dark brown, and after standing for some time became black. When naphthalene was discontinued, the symptoms vanished in four days.

Therapy.—Naphthalene is a useful antiseptic in treating ulcers, cancers,

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[1] *Journal of the American Medical Association.* Oct. 11, 1902 (von *Klin. Monatsblatt f. Augenheilkunde*). A. Lezenius, of St. Petersburg, Russia, reports the first case of actual cataract produced in man by ingestion of naphthalene. The patient was a pharmacist, 36 years of age, who took 5 Gm. of naphthalene, dissolved in castor oil, within 13 hours.

[2] *Berliner klinische Wochenschrift,* 1884, p. 593.

[3] *Berliner klinische Wochenschrift,* 42, 1884.

and pus-cavities; it can be used in watery emulsion, in alcoholic solution, or in a dry form. An alcoholic solution is used as an application to sprains and bruises.

In addition to the affections named, a naphthalene ointment is advantageously applied to chancres, chancroids, syphilitic ulcers, sloughing wounds, chronic eczema, and psoriasis. This ointment may contain 30 grains or more to the ounce of basis:—

℞ Hydrarg. chloridi mitis		65 Gm. or gr. x.
Naphthaleni	4	Gm. or 3j.
Ungt. camphoræ	27	Gm. or 3vij.

M. For chancroids, ulcers, and chronic eczema.

As a topical application in diphtheria, Kuznecow advises:—

℞ Mentholi	4	Gm. or 3j.
Alcohol., q. s. ad solv. et adde:—		
Naphthaleni	4	Gm. or 3j.
Ol. terebinth.,		
Glycerini aa	7	5 c.cm. or f3ij.—M.

In intestinal disorders due to infection—*e.g.*, typhoid fever, diarrhœa, and possibly in cholera—naphthalene is of eminent usefulness in diminishing the activity of the bacteria of the intestinal canal, as shown by C. Sehrwald, who also advises the use of calomel in conjunction with naphthalene in order to increase the bactericidal effect.

Naphthalene is said to diminish glycosuria when the patient is upon a mixed diet. For dysentery, Rossback advises the injection into the rectum of 0.65 Gm. (or gr. x) of naphthalene in decoction of marshmallow, at a temperature of 100° F. Naphthalene has also been administered internally in the treatment of this disease with good results.

It has also been found efficacious in the treatment of ascarides and tænia. For children a mixture has been recommended of the following composition:—

℞ Naphthaleni	28 to	50 Gm. or gr. ivss-viij.
Ol. ricini	15	c.cm. or f℥ss.
Olei bergamottæ		12 c.cm. or *m*ij.—M.

For tænia, adults may take 15 grains of naphthalene before eating, to be followed immediately by a dose of castor-oil. A single dose will often expel the worm entire even when other remedies have failed.

Chavernac maintains that the vaporization of naphthalene in the room exerts a beneficial influence upon whooping-cough. Scales of this substance, dusted into the shoes and stockings, are said to be of service in hyperidrosis.

Naphtalan, or **Naftalan,** is a dark-brown, unctuous substance with scarcely any odor. It is a purified naphtha mixed with 2 per cent. of anhydrous soap. It appears to combine the therapeutic properties of tar with those of naphtha. It has been used in eczema, sycosis, and common psoriasis, as well as in parasitic affections, such as ring-worm and scabies. It sometimes, when used freely, causes an eruption similar to tar-acne.

NAPHTHOL (B. P.).—**Betanaphthol.**

BETANAPHTHOL (U. S. P.).—**Betanaphthol** ($C_{10}H_7OH$).

Dose, 0.20 to 0.65 Gm. (or gr. iii-x).

Pharmacology.—Betanaphthol occurs as colorless scales, or as a white, crystalline powder; melts at 253.4° F.; is soluble in 75 parts of boiling water, and is freely soluble in boiling alcohol, ether, chloroform, and fixed oils. M. Charrin (*Le Bulletin Médical*) states that a saturated solution of boric acid in water increases the solubility of betanaphthol. Betanaphthol has a pungent taste, but is free from odor.

Both the naphthols and naphthalene can be readily tested by the distinctive color-changes which take place when melted in a test-tube with chloral-hydrate, adding to the chloral solution a few drops of hydrochloric acid and finally placing a small piece of zinc in the acidulated solution.

Physiological Action.—When taken internally naphthol gives rise to a sensation of warmth in the stomach. The fæces are softened and clay-colored. Diarrhœa is occasionally produced. Large doses sometimes cause vertigo, buzzing in the ears, and symptoms of cerebral hyperæmia. Betanaphthol is slightly stimulant to the skin and mucous membranes, allays pain and pruritus. It is one of the most powerful antiseptic agents, possessing three times the strength of carbolic acid or iodoform and four times that of creosote or naphthalene. It may be regarded as absolutely safe, since, according to Professor Bouchard's investigations, nearly half a pound would be required to cause death in a healthy person weighing 150 pounds.

On the contrary, cases of nephritis have been attributed to the influence of betanaphthol. Dr. Max Baatz has recently reported two cases, one of which proved fatal, in which this result was attributed to the use of an ointment containing naphthol. Both patients were children.

Therapy.—Betanaphthol is a valuable local remedy in parasitic diseases of the skin. An ointment containing 2 Gm. (or 3ss) to 31 Gm. (or ℥j) is destructive to pediculi and their ova. The same preparation is equally fatal to the itch-mite, and at the same time relieves the inflammation occasioned by the parasite. It soothes the irritation produced by the bites of fleas, bedbugs, and mosquitoes. The various forms of tinea trichophytina yield to the influence of naphthol ointment. A 10-per-cent. ointment of betanaphthol has been employed with advantage in cases of favus.

The itching of paræsthesia, urticaria, pemphigus, and prurigo is very successfully treated in the same manner. Betanaphthol is especially valuable when the skin is rough and infiltrated. In chronic eczema and psoriasis it is a reliable medicament. The secretions of the skin are favorably influenced, and it very often proves useful in the treatment of hyperidrosis and bromidrosis. Benefit also results from the employment of this substance in acne, seborrhœa, sycosis, alopecia circumscripta, lupus erythematosus and vulgaris, chronic ulcers, chancres, and chancroids. The remedy may be used in the form of a powder, lotion, or ointment. It is often well combined with bismuth or other mild powder, as:—

℞ Naphtholis	1|	Gm. or gr. xv.
Bismuthi subnitratis	31|	Gm. or ℥j.

M. For use as a dusting-powder.

The odor of cancer and eczema is overcome by naphthol. It is an excellent antiseptic dressing to wounds, and may often be advantageously employed, according to the method of Professor Reverdin, by impregnating

previously sterilized gauze bandages with an ethereal solution. An aqueous solution may be used with good result in mercurial salivation and chronic pharyngitis. Vaginitis, vulvitis, gonorrhœa, and gleet are notably improved by the use of naphthol. For gonorrhœa and gleet an injection may be composed as follows:—

℞ Naphtholis		32 Gm. or gr. v.
Glycerini	30	c.cm. or f℥j.
Aquæ	90	c.cm. or f℥iij.—M.

A solution of betanaphthol in glycerin and water is useful in chronic otorrhœa. Betanaphthol has been employed in diseases of the ear, the results being satisfactory in the majority of cases, though in a few the effects were apparently injurious. The powder was generally blown directly upon the diseased parts. At other times it was employed in the form of a 1 $^1/_2$- to 3-per-cent. alcoholic solution, allowing it to remain from two to five minutes. The more profuse the suppuration, the more frequently should the procedure be repeated.

An aqueous solution of the strength of 1 to 2500 has yielded good results in purulent ophthalmia. In simple or granular conjunctivitis and trachoma, likewise, this agent has proved a valuable remedy. This substance is very advantageously combined with camphor. Camphorated naphthol is formed by adding 1 part of naphthol to 2 parts of camphor, and is a colorless, syrupy liquid, well adapted for use as a local antiseptic. It may be beneficially employed in wounds, ulcers, sinuses, diphtheria, tubercular laryngitis, and, rubbed up with lard, it forms a valuable application in many diseases of the skin. M. Reboul has used camphorated naphthol with advantage in irrigation of diseased bones and joints, abscess-cavities, and tuberculosis of the bladder. He has also obtained good results in tuberculosis of glands from the interstitial injection of 4 to 5 minims of the fluid every eight or ten days. The intraperitoneal injection of camphorated naphthol has been attended with very encouraging results in tubercular peritonitis in the practice of Dr. Rendu, of Paris. Eruptions have sometimes followed the topical use of camphorated naphthol. Inhalations of betanaphthol are of service in pharyngitis, chronic nasal catarrh, hay asthma, whooping-cough, and chronic bronchitis.

Betanaphthol is administered internally chiefly as a means of securing antisepsis. Being almost insoluble, it is one of the best agents at our command for disinfection of the alimentary tract. In typhoid fever, it mitigates the severity of the disease and reduces the rate of mortality. The stools are deodorized, tympanites lessened, and the tongue moistened. Grave delirium rarely makes its appearance. These results, announced by Professor Bouchard, have been amply confirmed by the writer and numerous observers at home and abroad. Dr. Mitchell Bruce[1] concludes that the duration of typhoid fever is shortened, and the tendency to secondary complications overcome, by the use of betanaphthol. The testimony of Dr. Petresco, of Bucharest, is strongly to the same effect.[2] The remedy is equally valuable

[1] *Practitioner*, Dec., 1888.

[2] J. Petresco: "Recherches cliniques et expérimentales sur l'Antisepsie Médicale," Jan., 1889.

in the typhoid fever of young children. When the diarrhœa is profuse it is advisable to combine naphthol with bismuth salicylate, thus:—

℞ Naphtholis,
Bismuth. salicylat. ..... aa 8| Gm. or 3ij.
M. et div. in chartulæ no. xv.
Sig.: A powder every hour or as required.

Good results are derived from the internal administration of this drug in diphtheria, erysipelas, and scarlatina. In flatulent dyspepsia, chronic gastric or intestinal catarrh, and dilatation of the stomach, it is no less efficacious. The late Professor Dujardin-Beaumetz recommended, in dilatation of the stomach, the following combination:—

℞ Naphtholis.
Bismuth. salicylat.,
Magnes. calcinat. ..... aa 10| Gm. or gr. cl.
M. et div. in chartulæ no. xxx.
Sig.: One powder before each of the two principal meals.

In obstinate constipation, connected with disturbed digestion, the author has witnessed excellent results from 0.03 to 0.20 Gm. (or gr. ss-iij) doses of betanaphthol given three or four times a day. By some practitioners betanaphthol is highly esteemed as a vermifuge, particularly useful for the destruction of round worms. Dr. G. A. Gibson, of Edinburgh, has found betanaphthol, in the dose of 0.13 Gm. (or gr. ij) thrice daily, of decided efficacy in the treatment of simple and pernicious anæmia. Betanaphthol is likewise often of utility in chronic cystitis, and is well given in the form of tablet triturates. Milk, glycerin, and mucilage are also excellent vehicles for its administration.[1]

Salinaphthol, a combination of betanaphthol with salicylic acid, is said to act similarly to salol, without being as toxic, in articular rheumatism, in doses of from 0.25 to 0.50 Gm. (or gr. iv-viij).

Kobert believes that, by the action of the pancreatic juice and the intestinal ferments, naphthol with salicylic acid, or salinaphthol, is split up into salicylic acid in the urine. Lépine,[2] on the contrary, stated that the intestinal juice is incapable of producing this decomposition, but added that it may be brought about by the pancreatic secretion. The decomposition of salinaphthol he reports may be due simply to an alkaline reaction.

Microcidin.—Under the name of microcidin, a combination of betanaphthol with caustic soda has been introduced. Microcidin occurs in the form of a white powder, the principal constituent of which is sodium naphtholate. Microcidin is soluble in water, alcohol, and ether; is said to be superior to carbolic and boric acids in germicidal power, but somewhat inferior to naphthol and mercuric chloride. A weak solution is used upon wounds and ulcers and for the purpose of removing the odor of gangrene. Microcidin has been used with success in diseases of the ear, nose, and throat, generally in the proportion of 3 to 5 per 1000.

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[1] See papers by the author, "Naphthol: its Medicinal Use and Value," *Journal of the American Medical Association*, Oct., 1883: *Therapeutic Gazette*, Oct. 15, 1889.

[2] *Journal de Médecine de Paris*, Nov. 16, 1890.

Hydronaphthol, as the writer and others have already shown,[1] exists only as an impure form of betanaphthol.

Benzonaphthol, or betanaphthol benzoate, is obtained by the action of benzoyl chloride on betanaphthol. It is a whitish, crystalline, odorless, and tasteless powder, soluble in alcohol (warm), insoluble in water. It has been used with success as an intestinal antiseptic in doses of 0.20 to 0.65 Gm. (or gr. iii-x).

Lactonaphthol, or Lactol.—M. Coez has prepared a compound analogous to benzonaphthol. Lactonaphthol, or lactol, is the lactic ether of naphthol, and is decomposed in the alimentary canal into its components. It is without taste and has been taken without inconvenience in daily doses of 1 Gm. (or gr. xv).

Asaprol.—This name was given by MM. Dujardin-Beaumetz and Stackler to one of the derivatives of betanaphthol, viz.: the sulphuric ether of betanaphthol, in combination with calcium, the beta-naphthol-alpha-monosulphonate of calcium. Asaprol presents itself in the form of a white powder, extremely soluble in water and alcohol. It is incompatible with alkaline iodides, sulphates, and most of the alkaline salts. Its antiseptic properties are nearly equivalent to those of sodium salicylate. It allays pain and reduces temperature in different diseases, and is of special service in acute inflammatory rheumatism. It may be administered in doses of 0.38 to 1 Gm. (or gr. vi-xv), or 4 Gm. (or 3j), in the day.

Asaprol is rapidly eliminated by the kidneys. Its presence in the urine may be detected by the addition of ferric chloride, which produces a black color tending to blue. Asaprol is comparatively free from toxicity. It does not occasion vertigo or buzzing in the ears. It was tolerated without inconvenience by dyspeptic patients and those suffering from albuminuria. In some cases of influenza Stackler found asaprol efficient in reducing fever and alleviating pain. He obtained good results from its use also in gout, asthma, furunculosis, anthrax, tonsillitis, and various infective conditions.

Orphol.—Betanaphthol-bismuth (von Heyden): a naphtholate of bismuth containing 80 per cent. of bismuth oxide and 20 per cent. of betanaphthol. In the intestinal tract it is decomposed into bismuth oxide and naphthol. It is useful in infectious conditions of the intestinal tract and in diarrhœa. Dose, 0.65 Gm. (or gr. x) every two hours. It may be obtained in tablets of 0.32 Gm. (or gr. v) each.

Iodonaphthol.—A combination of betanaphthol and iodine, known also as di-iodide of betanaphthol,—a greenish-yellow, tasteless, and odorless powder, soluble in chloroform, slightly soluble in alcohol, ether, and acetic acid, and insoluble in water,—has been applied as an antiseptic dusting-powder to wounds and ulcers.

Naphthol, Alpha-.—Alpha- and beta- naphthols are obtained by heating together, for several hours, naphthalene and sulphuric acid. A large quantity of hot water being then added to the mixture, the excess of naphthalin is filtered off and the solution saturated with lead carbonate. From these lead-naphthalin sulphonates the respective acids are prepared, and from the acids fused with an alkali two naphthols are made: the alpha and beta. Betanaphthol, which is official and has just been considered, is the first to

[1] See papers by the author: "The Imputations on Betanaphthol," and "The Betanaphthol *vs.* Hydronaphthol Contention." *Journal of the American Medical Association*, July 14, 1888, and May 11, 1889.

crystallize, and is readily separated from the alpha variety by boiling alcohol, in which the latter is insoluble.

A simple test for distinguishing between alpha- and beta-naphthol is given by M. Aymonier. A few drops of a mixture consisting of 1 Gm. (or gr. xv) of potassium bichromate, 1 c.cm. (or *m*xv) of pure nitric acid, and 10 c.cm. (or f℥ii*m*xlv) of distilled water will at once produce with alphanaphthol a black precipitate, while betanaphthol is unchanged by the reagent.

Pure alphanaphthol is perfectly white, melts at 122° C. (241.6° F.), and boils at 286° C. (546.8° F.). Genois shows that when alphanaphthol is treated with ferric chloride the solution turns green, and white dinaphthol is precipitated. Alphanaphthol is insoluble in cold and slightly soluble in hot water. It is very soluble in ether and alcohol, from either of which it crystallizes in white, shining needles. Alphanaphthol has an aromatic odor and somewhat pungent taste, and is converted, with heat and hydrochloric acid, into naphthalene and sulphuric acid. Genois states that impure alphanaphthol is dangerous and quite unfit for medicinal use.

Physiological Action.—Alphanaphthol, used internally, produces warmth in the stomach, stimulates the glands of the entire gastro-intestinal tract, and tends to make the fæcal discharges of rather a soft consistency. Large doses have caused increase in the arterial tension and symptoms of cerebral hyperæmia. The systemic action of alphanaphthol differs but little from that observed from the administration of betanaphthol. Alphanaphthol has marked antiseptic properties. Maximovitsch reports (*Merck's Bulletin*) that alphanaphthol, in the proportion of 1 to 10,000 of culture-gelatin, prevents the growth of most of the various pathogenic microbes; even in the proportion of 0.6 or 0.8 to 10,000 it retards the development of microbes by three to eight days. Sternberg has demonstrated that both naphthols restrain the growth of the comma bacillus according to the strength in which they are used. Maximovitsch further adds that similar antiseptic effects were produced by betanaphthol, but twice as much, he reports, had to be used to produce the same results. Alphanaphthol has a stimulating and astringent action upon the skin.

Therapy.—Alphanaphthol, from the writer's experience, is certainly a good antiseptic. It is also a useful disinfectant. Alphanaphthol solution, from 0.065 to 2 Gm. to 30 c.cm. (or gr. i-xxx to f℥j) of distilled or boiled water, is serviceable in treating wounds or ulcers, and for all surgical procedures requiring an antiseptic agent. Alphanaphthol solutions are beneficial in seborrhœa, acne, rosacea, chronic eczema, and alopecia. Nasal catarrh, buccal inflammations, pharyngitis, and laryngitis are often relieved or removed by the application of alphanaphthol solutions. The solution can, in the diseases just named, be used with advantage in the form of a spray. Solutions of alphanaphthol can be employed with advantage in injections for gonorrhœa in both sexes, in gleet, in leucorrhœa, and in irritation and inflammation of the lower portion of the rectum. Alphanaphthol incorporated in some fatty substance (0.32 to 4 Gm. to 31 Gm., or gr. v to lx to the ounce), as lard, suet, butter, lanolin, zinc or lead ointment, can be used for very many diseases of the skin, such as chronic acne, rosacea, psoriasis, chronic eczema, alopecia circumscripta, and for chronic ulcers. According to the author's experience, alphanaphthol, while a good stimulating and astringent substance, having also antiseptic properties, lacks, to a great extent, the anæsthetic or sedative effects upon the integument which belong to beta-

naphthol. Further, the internal use of alphanaphthol has not been followed, in the writer's experience, with that decided action observed from betanaphthol. Alphanaphthol can, however, be employed internally in from 0.03 to 0.32 Gm. (or gr. ss-v), three or four times a day, for chronic catarrh of the stomach or bowels, and in constipation. It can also be used as an antiseptic in smaller doses (0.015 to 0.65 Gm., or gr. $^1/_4$-x, three or four times a day) in typhoid and other fevers.

The author recommends, when tympanites and abdominal pains are excessive in typhoid fever, the following combinations:—

℞ Betanaphthol	50 Gm. or gr. viij.
Bismuth. subnitrat.	28 Gm. or gr. ivss.
Pulv. rhei	20 Gm. or gr. iij.
Ext. belladonnæ folior.	01 Gm. or gr. $^1/_6$.

M. Sig.: Four to six such powders daily.

Or:—

℞ Betanaphthol	50 Gm. or gr. viij.
Codein.	01 Gm. or gr. $^1/_6$.
Pulv. rhei	10 Gm. or gr. iss.
Cinnamom. zeylan.	20 Gm. or gr. iij.

M. Sig.: Four to six such powders during the day.

NECTANDRÆ CORTEX.—Nectandra-bark, Bebeeru-bark. The bark of Nectandra Rodiæi (Laurineæ), of British Guiana, contains tannin and an alkaloid discovered by Maclagan, **Beberine** (not the same as **berberine**). The alkaloid is said by Flückiger to be identical with buxine, derived from Buxus sempervirens and from pareira. Pure beberine is a white, amorphous powder, bitter to the taste and devoid of odor, soluble in alcohol and ether, but sparingly soluble in water. Beberine sulphate occurs in the form of thin, dark-brown scales, of bitter taste, soluble in water and alcohol. Another alkaloid, termed **Sipirine,** insoluble in ether, has been separated. **Nectandrine**, also an alkaloid, is present in the wood.

Physiological Action and Therapy.—Beberine sulphate produces tetanic spasms in frogs. In the human subject the bark or alkaloid increases appetite, improves digestion, is somewhat astringent, and possesses some antiperiodic power. It is said not to produce headache or ringing in the ears. It may be employed in atonic dyspepsia and conditions of general debility. Bebeeru-bark was introduced as a substitute for quinine. Though often successful in breaking up malarial fever, it is far less reliable than cinchona. It has been given with benefit in periodical headache and neuralgia. This remedy has also been employed with asserted advantage in menorrhagia, leucorrhœa, and strumous ophthalmia.

NIRVANIN is a synthetical product with properties resembling those of both orthoform and cocaine. It is said to have the following chemical formula: di-ethyl-glycocyl-para-amido-ortho-oxy-benzoic-acid-methyl-ester hydrochloride, and is produced by substitution. It crystallizes out from absolute alcohol in colorless prismatic crystals, but is readily soluble in water, giving a neutral solution. A few drops of a 5-per-cent. solution causes complete anæsthesia of the conjunctiva. It also causes local anæsthesia when administered hypodermically, so as to permit of minor surgical operations.

It is decidedly analgesic, even in solutions of 1 per cent. Owing to the stability of the solutions, it is preferable to cocaine for infiltration anæsthesia by Schleich's method. It is said to be only one one-hundredth as toxic as cocaine. As much as 0.50 Gm. (or gr. viij) has been injected hypodermically without toxic effects. This agent is not adapted for application to the surface of mucous membranes nor to the eye, as a rule, on account of its irritating and non-penetrating powers as compared with cocaine or eucaine. It is especially serviceable to dentists, in 5-per-cent. solution, to relieve pain during extraction of teeth on account of its feeble toxic action and its more prolonged anæsthesia than either cocaine or eucaine. It is supplied in the form of a powder and in tablets of 0.032 Gm. (or gr. ss) for hypodermic use.

NITROGLYCERINUM.—**Nitroglycerin.** (See **Glonoinum.**)

NUCLEIN.—A proteid principle extracted from living cells, especially yeast-cultures. It produces leucocytosis when administered by the mouth or hypodermically, and is used to combat sepsis, and infectious diseases. Combinations with various metals are made, *i. e.*, with silver (nargol), with copper (cuprol), with iron (ferrinol), and with mercury (mercurol).

NUX VOMICA (U. S. P., B. P.).—**Nux Vomica, Poison Nut.**
Dose, in powder, 0.065 to 0.25 Gm. (or gr. i-iv).

Preparations.

Fluidextractum Nucis Vomicæ (U. S. P.).—Fluid Extract of Nux Vomica. (Assayed 100 c.cm. = 1 Gm. of strychnine.) Is one-fifth the strength of the powdered extract. Dose, 0.06 to 0.30 c.cm. (or *m*i-v).

Extractum Nucis Vomicæ Liquidum (B. P.).—Liquid Extract of Nux Vomica. Dose, 0.06 to 0.18 c.cm. (or *m*i-iij).

Extractum Nucis Vomicæ (U. S. P., B. P.).—Extract of Nux Vomica. Dose, 0.015 to 0.03 Gm. (or gr. $^1/_4$-ss). B. P., 0.015 to 0.065 Gm. (or gr. $^1/_4$-j).

Tinctura Nucis Vomicæ (U. S. P., B. P.).—Tincture of Nux Vomica (contains 1 per cent. of strychnine, and is made from the extract; B. P., liquid extract). Dose, 0.30 to 1.20 c.cm. (or *m*v-xx).

Alkaloids and Preparations of Alkaloids.

Strychninæ Nitras (U. S. P.).—Nitrate of Strychnine. Dose, same as sulphate.

Strychninæ Sulphas (U. S. P.).—Strychnine Sulphate. Dose, gr. 0.001 to 0.003 Gm. (or gr. $^1/_{60}$-$^1/_{20}$).

Strychnina (U. S. P., B. P.).—Strychnine. Dose, 0.001 to 0.003 Gm. (or gr. $^1/_{60}$-$^1/_{20}$).

Strychninæ Hydrochloridum (B. P.).—Hydrochloride of Strychnine. Dose, 0.001 to 0.004 Gm. (or gr. $^1/_{60}$-$^1/_{15}$).

Ferri et Strychninæ Citras (U. S. P.).—Iron and Strychnine Citrate. Dose, 0.20 to 0.32 Gm. (or gr. iii-v).

Elixir Ferri, Quininæ, et Strychninæ Phosphatum (U. S. P.).—Elixir of the Phosphates of Iron, Quinine, and Strychnine.

Glyceritum Ferri, Quininæ, et Strychninæ Phosphatum (U. S. P.).—Glycerite of the Phosphates of Iron, Quinine, and Strychnine.

Syrupus Ferri, Quininæ, et Strychninæ Phosphatum (U. S. P., B. P.).—Syrup of the Phosphates of Iron, Quinine, and Strychnine. Dose, 2 to 4 c.cm. (or f3ss-j).

Liquor Strychninæ Hydrochloridi (B. P.).—Solution of Strychnine Hydrochloride (1 per cent.). Dose, 0.12 to 0.50 c.cm. (or *m*ii-viij).

Pharmacology. — Nux vomica is "the seed of Strychnos Nux-vomica (Loganiaceæ)," of East Indies, yielding, when assayed by the process given, not less than 1.25 per cent. of strychnine (U. S. P.). The seeds are disk-shaped, about an inch in diameter, covered with silky hairs, of a greenish-

gray color, and grayish-white internally. Odor none, but the taste is very bitter. **Strychnine** and **Brucine**, with **Igasuric Acid**, are the important constituents, besides fixed oil, tannin, etc. A third alkaloid, isolated by Desnois in 1853, and termed **Igasurine**, has been shown by Jorgensen to respond to all the tests for brucine, and, in fact, to be identical with it.

The tincture of the present Pharmacopœia is about 20 per cent. weaker than that of 1890.

As the powdered drug varies in alkaloidal strength, in making the fluid preparations, the Pharmacopœia now requires them to be standardized in order to insure uniformity of physiological and therapeutical effect. Strychnine represents the medicinal activity of nux vomica. Strychnine crystallizes out of alcohol in the form of colorless prisms and dissolves in pure sulphuric acid without change of color. If a few drops of this solution be placed upon a white plate and an equal quantity of potassium-bichromate solution be cautiously brought into contact with its edge, a beautiful and characteristic play of colors is produced, ranging through blue, purple, crimson, and red-brown. This color-change is distinctive, and is available as a delicate test for strychnine. Morphine obscures this test, and hence, if present, should first be removed by means of an alkaline mixture of chloroform. A physiological test is also utilized in cases of suspected poisoning: 0.00006 Gm. (or gr. $^1/_{1000}$) of strychnine sulphate in a drop of water, applied to the dried skin of a frog, will produce spasm in about ten minutes. Brucine, which gives rise to a similar physiological reaction, is likewise a crystalline body, soluble in 320 parts of cold or 150 parts of boiling water, has a strongly-bitter and persistent taste, and, although generally resembling strychnine in its properties, will sometimes destroy life without the occurrence of convulsions. Strong sulphuric acid strikes a blood-red or scarlet color with brucine and its salts. Igasurine occurs in colorless, silky prisms; is more soluble in water than either of the other alkaloids; has a similar bitter taste and toxic action: and is colored rose-red by strong sulphuric acid, just like brucine and its salts. These are all soluble in water and in alcohol, making intensely-bitter preparations, thus rendering the pill form best for administration.

Physiological Action.—In minute doses, repeated three or four times daily, which is the best way to get its tonic effect, strychnine increases the appetite, stimulates secretion, improves digestion, and exalts the vital powers, improving also sight and hearing. Strychnine is a stimulant to the respiratory centre, also to the heart and vasomotor centres. Arterial pressure is raised and the pulse becomes slower. The pupil dilates under its influence. Peristalsis is increased and the bowels somewhat loosened; even diarrhœa may result from full doses.

From experiments upon dogs, Agricolansky has ascertained that large doses of strychnine suppress the pancreatic secretion. Smaller quantities either produce no effect or slightly stimulate the gland. The presence of a small amount of strychnine in the pancreatic juice seems to promote its amylolytic action. Strychnine stimulates the genito-urinary system, has some influence upon the muscular tissue of the uterus, favors the occurrence of the menses, increases the venereal appetite, and excites erections. Dr. E. Maurel has published some interesting researches regarding the influence of strychnine upon the leucocytes of the blood. From his observations he believes that these cells exhibit, in different animals, a specific sensibility to

its action, and that in accordance with the susceptibility of the leucocyte is that of the animal. The functions of the spinal cord are exalted as well as stimulated, according to Biernacki,[1] and especially those of the anterior gray columns; but a very large dose paralyzes and destroys them. The brain is not affected directly until the accumulation of carbonic-acid gas in the blood causes coma and insensibility.

Biernacki states, however, that subcutaneous injection of small doses of strychnine nitrate reduces the electrical excitability of the cerebrum.

This drug is absorbed rather slowly by the stomach, more rapidly by the rectum. Its toxic effects are, consequently, more promptly manifested after injection into the rectum than when administered by the mouth. Strychnine is slowly excreted by the kidneys, but elimination is more rapid in children than in old people. Strychnine also escapes in the saliva. It, therefore, tends to accumulate in the system, and produce muscular stiffness, cramps, and other symptoms of toxic action. Dr. Woodley Stocker has observed, in his own person and in others, flushing of the face, throbbing of the head, giddiness, and faintness caused by doses of strychnine sufficiently large to approach the physiological limit.

On account of its slow rate of absorption and elimination, its exhibition should be occasionally suspended for a time, lest a dangerous quantity accumulate within the system. Strychnine is a local irritant. It possesses some antiseptic virtue, and, to a certain extent, inhibits the movements of leucocytes, though far feebler in this respect than quinine. A bright-red eruption has been observed to follow the administration of a small dose of strychnine in exceptional cases.

Poisoning by Strychnine.—When a relatively large dose (0.02 to 0.03 Gm., or gr. $^1/_3$-ss) is given to an adult and absorbed, the face is drawn into a grin (*risus sardonicus*), the lower jaw becomes immovable, the neck rigid, the pupils dilate, the reflexes are heightened so that the muscles contract spasmodically and painfully; then paroxysmal attacks of tonic contraction, especially of the extensor muscles of the body, in which the patient assumes the position of opisthotonos, occur; finally, the muscles of respiration become tetanically fixed, and death occurs from apnœa and carbonic-acid accumulation in the blood, producing narcosis. Dr. Perry has reported a case of strychnine poisoning in which, four days after the immediate convulsive effects had ceased, paralysis of the muscles of the upper and lower limbs and of the intercostal muscles occurred. Dyspnœa increased rapidly and the patient died from asphyxia. The kidneys were injected. The fatal result may ensue in a few minutes if the dose be a large one. About 0.03 Gm. (or gr. ss) may be regarded as a minimum fatal dose. It acts more rapidly and effectively when given by the rectum, or hypodermically, than when swallowed. As is the case with other active poisons, the lethal dose varies within considerable limits. Death has resulted from 0.03 Gm. (or gr. ss) of strychnine or 0.20 Gm. (or gr. iij) of extract of nux-vomica; on the other hand, as much as 0.38 Gm. (or gr. vj) of strychnine sulphate has been taken without fatal effect. When a fatal dose has been taken death is not usually long delayed. Recovery is the rule if the patient survives for three hours. Dr. Taylor, in his work on poisons, states that six hours is the longest recorded period for a fatal issue. A case, however, has been described by Dr. Thomas J. Henry, of Warialda,

[1] *Therapeutische Monatshefte*, Aug., 1890.

New South Wales, in which death was postponed for nine hours after about 0.65 Gm. (or gr. x) had been taken, the patient in the interval having been under treatment. A fatal case of chronic poisoning in a woman is reported by Dr. A. H. Falconer,[1] of Louisville, Ky. The principal symptoms were extreme weakness, muscular pains, stiffness of muscles at the back of the neck, clonic convulsions of forearm with contracture of flexor tendons of fingers. She also had vertigo, amblyopia, weak—but regular—pulse. Temperature slightly elevated. Tongue coated and swollen, bowels constipated, frequent chilly sensations. Delirium preceded death, which occurred during a convulsive attack. The patient had taken 0.002 Gm. (or gr. $^1/_{30}$) of strychnine four times a day for eight months, which had been prescribed by a physician for "nervousness."

A very instructive case, showing the after-effects which may be caused by strychnine poisoning, has been published by Dr. G. Honigmann, from the clinic of Professor Riegel, of Giessen.[2] A man who suffered from the classical symptoms of this accident had recovered under the liberal use of chloral-hydrate. At the expiration of twenty hours after taking the poison only a minute quantity of urine had been voided. Albumin was unmistakably present. There was abdominal pain with constipation. During the second night a small quantity of clear urine was passed, which contained an abundant precipitate of albumin. It deposited a sediment in which were detected both white and red blood-corpuscles and a few hyaline casts. The pain and constipation continued and the pulse remained slow and strong. On the fourth day albuminuria persisted; the urine was still scanty; the sediment rich in blood-corpuscles, hyaline and epithelial casts, with renal epithelium. The kidneys began to resume their functions upon the fourth and fifth days, after the skin had been roused to free perspiration. The albumin, casts, and cells began to decrease at the same time, but did not finally disappear until the fourteenth day. During all this time the pulse remained very slow. The renal insufficiency and albuminuria were probably due to limitation of the circulation through the kidney by contraction of its vessels. But the composition of the sediment indicated that a more permanent injury had occurred. The reporter plausibly conjectured that the renal epithelium had been affected, giving rise to an acute glomerulonephritis.

Diagnosis of Strychnine Poisoning.—The convulsions do not resemble those occurring during the epileptic paroxysm, because they are always tonic, and never clonic, in character. They may be distinguished from those of tetanus by the history of the case and by the symptoms. In tetanus the muscles of the lower jaw are first attacked; locked jaw exists for some time before the other muscles are involved; moreover, in tetanus they do not entirely relax; some remain rigid; whereas, in strychnine poisoning, all the muscles are affected almost simultaneously, the body being thrown into opisthotonos with each paroxysm. In what is known as tetany, the muscles about the neck are usually not affected, but there is persistent rigidity of other muscles. In hysterical convulsions the muscular contractions are not painful, and the patient does not retain full sensation, nor full consciousness, but is in a dreamy or stupid condition. In convulsions of hydrophobia

[1] *The American Practitioner and News*, July 1. 1898, vol. xxvi, p. 9.

[2] *Deutsche medicinische Wochenschrift*, May 30, 1889; *Medical Bulletin*, Oct., 1889.

the patient is semidelirious, there are no tonic spasms of muscles or cramps, and there is a history of a wound from an animal.

Antidotes and Treatment. — Tannin is the chemical antidote to nux vomica and to strychnine. The antidote should be given immediately, and a convenient form is tea or coffee that has been standing for an hour or more, giving grounds or leaves and all, washing out the stomach afterward with warm water or coffee. After spasm has developed, the introduction of the tube may excite convulsions. In order to obviate this occurrence the patient should be placed under the influence of amyl nitrite[1] or chloroform. The same caution applies to catheterism. The physiological antidotes are potassium bromide, chloral, paraldehyde, and physostigmine, or Calabar bean. Amyl nitrite, chloroform, or ether inhalations may be cautiously employed at the onset of the paroxysms, and artificial respiration practiced. The catheter should be used frequently, and the bowels thoroughly evacuated with croton-oil. The physiological antidotes may be given by the rectum. If relaxation does not occur, nitroglycerin may be injected hypodermically. Animal charcoal and fats are useful adjuvants. Sanquirico prefers paraldehyde to chloral, and warmly recommends intravenous injections of a considerable quantity of an 8-per-cent. soda solution, which produces active diuresis and elimination. Opium and conium may also be brought into requisition as physiological antidotes. Dr. Whitla[2] writes with decided approval of tobacco and alcohol in poisoning from strychnine. He states that he would not hesitate to use alcohol alone in a desperate case, and believes that it will afford the best chance of success in dealing with the spasms, but poisonous doses must be boldly administered by the mouth and rectum. The use of tobacco should be discouraged, as it is not the antidote for strychnine.[3] Chloroform has been given by the mouth (4 to 7.5 c.cm., or f℥i-ij) successfully. Paraldehyde is also a reliable antidote.

Siebold, in some experiments conducted upon himself as to the physiological action of strychnine,[4] reports that tannin in 0.65 Gm. (or gr. x) doses was valueless as an antidote. Charcoal in 31 Gm. (or ℥j) doses had some slight effect, injections of morphine were useful, but chloral-hydrate and chloroform sufficed to entirely prevent the muscular contractions, when administered in time. Dr. W. D. Turner[5] was led by the accidental observation of the recovery of a dog from strychnine poisoning after eating about 124 Gm. (or ℥iv) of lard to make a series of experiments on dogs and other animals. He records 13 experiments in all: 3 on dogs, 3 on hens, 1 on a crow, 4 on hogs, and 2 on calves. In all cases, except the first 2 hogs (which died from 0.13 Gm., or gr. ij, each of strychnine, with only 186.6 Gm., or ℥vj, of lard administered as an antidote, the last two, however, recovering from the same dose of strychnine after taking 373 Gm., or ℥xij, of lard), the animals recovered, although the lard was not administered until after convulsions had well set in.

Therapy. — Nux vomica is not applied externally, and, although an oleate of strychnine is made, yet it has little, if any, use on account of its

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[1] Robert Barnes reported (in the *British Medical Journal*, April 1, 1882) a case successfully treated by inhalation of amyl nitrite.

[2] *Op. cit.*, p. 338.

[3] "Chloroform Should be Used in Strychnine Poisoning, not Tobacco."—Francis L. Haynes, M.D., *Philadelphia Medical Times*, vol. xiv, p. 504.

[4] *The Chemist and Druggist*, Sept. 6, 1890.

[5] *Indian Lancet*, June 1; *New York Medical Journal*, July 23, 1898.

uncertainty with regard to absorption. According to Dr. Thomas J. Mays, of Philadelphia, an oleate of brucine may be used in paræsthesia of the skin and to relieve itching piles. Mackenzie has known anosmia to be benefited by the insufflation, twice daily, of a powder containing 0.0027 Gm. (or gr. $^1/_{24}$) of strychnine and 0.13 Gm. (or gr. ij) of starch.

Strychnine not being very soluble, its salts, sulphate or acetate, may be used hypodermically in the treatment of paralysis (0.0008 to 0.001 Gm., or gr. $^1/_{80}$-$^1/_{60}$), or injected into the tissues around the eye for amaurosis in tetanus,[1] as an antidote to snake-poison[2] and tobacco-alcohol amblyopia.

Mr. D. B. Dott recommends strychnine hydrochloride as regards solubility, neutrality, and stability, and considers it the most useful of the salts of the alkaloid. Strychnine nitrate is preferred by many on account of its producing less local irritant effect. It may be used in doses of 0.001 Gm. (or gr. $^1/_{60}$), cautiously increasing until evidence of physiological action is manifested. The dose is then temporarily decreased, to be again raised in such a manner that the physiological effect is obtained about once a week in the treatment of such affections as tobacco-alcohol amblyopia.

The circumstantial reports of many Australian and East-Indian physicians, of a number of severe and threatening cases of snake-bite successfully treated by strychnine, leave no doubt as to its value. It is necessary to employ the remedy in large doses, carefully observing its effects. The symptoms due to the snake-poison are progressively relieved and no tetanic spasms indicative of strychnine intoxication are produced. According to the severity of the condition, amounts varying from 0.05 to 0.20 to 0.25 Gm. (or gr. $^5/_6$-iii or iv) were given in divided doses in different cases. Dr. E. A. Thomas obtained the same results in five cases from strychnine administered by the mouth, but, as the patient is generally unable to swallow, and on account of the greater rapidity of its action when injected, the hypodermic method is usually the best. On the contrary, from an elaborate series of experiments upon animals, Surgeon-Lieutenant R. H. Elliot, of the British Army, concludes that in animals poisoned by cobra-poison the subcutaneous injection of strychnine often hastens, while it could never be said to retard, death. Dr. Bancroft,[3] after experiments on guinea-pigs, declares that hypodermic injection of strychnine for snake-poison is useless. The subcutaneous injection of strychnine is beneficial in paralysis due to alcoholism, and has been practiced with admirable results by Dr. Königsdörfer in the treatment of toadstool poisoning.

Internally, the tincture of nux vomica does good as a bitter tonic, and in sick headache from disordered stomach. Ringer gives it in 1-drop doses in a teaspoonful of water, every ten or fifteen minutes, until relief is obtained, or for a couple of hours.

Cases of nausea and vomiting of pregnancy, not infrequently, yield to minute doses of the tincture, a drop, or a fraction of a drop, being given in water, and repeated every hour or two hours. This preparation, likewise,

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[1] "Strychnine as a Preventive of Tetanus," by Dr. Peyraud, *Bulletin Médical*, Sept. 2, 1890.

[2] "Strychnine as an Antidote to Snake-poison," by Dr. Muller, *Druggists' Circular and Chemical Gazette*, Jan., 1891; "Snake-poison and its Antidotes," by T. Lauder Brunton, M.D., F.R.S., *British Medical Journal*, Jan. 3, 1891.

[3] "Strychnine in Snake-bite," *Journal of the American Medical Association*, Feb. 21, 1891.

does excellent service in the morning vomiting to which drunkards are subject. Nux vomica, indeed, fulfills more than one indication in this class of patients. It is beneficial in the chronic gastritis of alcoholism, and affords support to the system when the accustomed alcoholic stimulus is suddenly withdrawn. The poor appetite and digestion, the miserable sense of weakness, the insomnia and tremor are relieved by the tincture of nux vomica. At the same time, and especially being combined with capsicum, it diminishes the craving for drink, and is of value in assisting to break up the habit. Dr. Jaroshensky has demonstrated by experiments upon dogs that the toxic and narcotic effects of alcohol are neutralized by the administration of strychnine. Hypodermic injections of strychnine nitrate are recommended by various Russian physicians as curative of the alcohol habit. Dr. Portugalow has published a record of 455 cases treated with satisfactory results. He employs the following formula:—

℞ Strychnin. nitrat.		.065	Gm. or gr. j.
Aquæ destillat.	15		c.cm. or f℥ss.—M.

He begins with one or two daily injections of 0.50 c.cm. (or *m*viij), subsequently reducing the quantity to 0.24 c.cm. (or *m*iv). The treatment is said to destroy soon the taste for liquor, though, on the other hand, Dr. Rabow states that his experience with the method has failed to convince him of its value. Dr. J. Bradford McConnell, of Montreal, made trial of strychnine injections in twenty-five cases of alcoholism. This writer testifies that the craving for alcohol diminished rapidly and was completely lost in a few days. The physical and mental health was gradually restored, but the effect was not permanent, as most of the cases relapsed in from one to eleven months.

Keener recommends the addition of pilocarpine to the strychnine solution in the strength of 0.065 Gm. to 30 c.cm. (or gr. i-f℥j). At the same time he administers internally the following mixture:—

℞ Hydrarg. chlor. corr.	.065 to	.13	Gm. or gr. i-ij.
Fluidext. sterculiæ	4		c.cm. or f℥j.
Fluidext. cacti grandiflor.	30		c.cm. or f℥j.
Fluidext. arnicæ	9	25	c.cm. or f℥iiss.
Tr. aloes	7	5	c.cm. or f℥ij.
Tr. cannabis Ind.	15		c.cm. or f℥ss.
Aq. destill.	120		c.cm. or f℥iv.

M. Sig.: Teaspoonful every two hours during the day.

The gastric catarrh dependent upon chronic disease of other organs, as bronchial tubes, heart, or liver, is also alleviated, as Ringer has pointed out, by the administration of 1 or 2 drops of the tincture in a teaspoonful or two of water every two hours, or oftener, for twenty-four to forty-eight hours. Prolonged and obstinate vomiting, due to malaria, has been overcome by the administration of full doses of strychnine. In atonic dyspepsia and insufficient secretion, nux vomica is useful in pills, with quinine and some carminative. Owing to its effects upon motor nerves, it is valuable in constipation produced by defective muscular activity, and also in the form due to lead poisoning. In the former condition the contractions of the lower bowel become so energetic that, according to Whitla, the stools are occasionally much altered in size, and may be seen to present the attenuated appearance observed in stricture of the rectum. The effects of nux vomica in

constipation are often enhanced by a combination with a purgative and chalybeate.

For constipation, nux vomica can be commended combined as follows:—

℞ Extracti nucis vomicæ		32 Gm. or gr. v.
Extracti belladonnæ folior.		20 Gm. or gr. iij.
Extracti rhamni pursh.	1 to 2	Gm. or gr. xv vel xxx.

M. et ft. pil. no. xxx.
Sig.: A pill after each meal.

℞ Extracti nucis vomicæ		32 Gm. or gr. v.
Pulveris ipecacuanhæ		65 Gm. or gr. x.
Extracti hyoscyami	1	30 Gm. or gr. xx.

M. et ft. pil. no. xx.
Sig.: A pill three times a day.

Waugh recommends for constipation this prescription, containing nux vomica:—

℞ Extracti nucis vomicæ,		
Aloes purificat.	aa	32 Gm. or gr. v.
Extracti belladonnæ folior.		20 Gm. or gr. iij.
Oleoresina capsici		12 c.cm. or *mij*.

M. et ft. pil. no. xx.
Sig.: One pill after each meal until two passages occur in a day, when half pills are to be taken; and the reduction is to be continued until the habit of regular evacuations has been formed.

Atony of the large intestine leads to prolapsus ani, and here, also, the tincture of nux vomica is of advantage, both by internal administration and local injection. Phillips has seen excellent results, in hæmorrhoids, from the tincture. In opposite conditions of the intestine, and for different reasons, strychnine is remedial. In nervous or atonic diarrhœa it materially assists the action of other remedies, and may be thus prescribed with advantage:—

℞ Strychninæ sulphat.		03 Gm. or gr. ss.
Acidi sulphurici aromat.	18	5 c.cm. or f℥v.
Aq. hamamelidis dest.	q. s. ad 120	c.cm. or f℥iv.

M. et ft. sol.
Sig.: A teaspoonful in water every three hours.

In dysentery attended by unusual prostration and tympanites, this remedy has proved of advantage. In combination with a mineral acid it has sometimes seemed to do good in Asiatic cholera. Hypodermic injections of strychnine answer a valuable purpose in cholera, especially when collapse is threatened or is present. This practice has been beneficially followed by Dr French-Mullen in hundreds of cases.[1]

Strychnine is one of the best of the cardiac stimulants in failing heart or weakness of the circulation. Prof. Thomas G. Morton uses it in surgical shock. Weakness of the heart due to depressed nerve-force and dilatation of the heart are materially benefited by strychnine. It is a good plan to give this remedy sometimes in combination, and again alternating, with digitalis. Iron is often profitably added to the combination, as:—

[1] *Indian Medical Gazette*, July, 1892.

℞ Strychninæ sulph.	.02	Gm. or gr. 1/3.
Tinct. ferri chloridi	7.5	c.cm. or f3ij.
Infus. gentianæ	q. s. ad 180	c.cm. or f3vj.

M. Sig.: Tablespoonful in water three times a day.

In fatty heart it is capable of service, but should be given with circumspection, since it will sometimes induce a nervous and sleepless state, which is decidedly harmful to the patient. In emphysematous asthma it is especially serviceable. The various forms of muscular paralysis—hemiplegia, paraplegia, diphtheritic paralysis, wrist-drop—are well treated by strychnine internally, or hypodermically (0.0005 Gm., or gr. 1/120) thrown deeply into the affected muscles, in conjunction with electricity. It has also been employed with success in infantile palsy and writers' cramp. In progressive lead palsy strychnine stops the advance of the disease if used in full doses, a careful watch being kept up for toxic symptoms and potassium iodide being given simultaneously on account of its eliminative effects. The use of strychnine three or four times daily is also stated to be of particular efficacy in lead colic. Other forms of paralysis in which this agent renders conspicuous service are torticollis; mercurial, malarial, and hysterical paralysis; neurasthenia from sexual excess, and aphonia due to paralysis of the vocal cords. In conjunction with out-door life and calisthenics, nux vomica is useful in lateral curvature of the spine. In atony of the bladder, leading to incontinence or retention, a combination of strychnine and electricity forms the most valuable restorative means at our command.

In general nervousness with depression of spirits Dr. Emmet prescribes:—

℞ Strychnin. sulphat.	.065	Gm. or gr. j.
Quinin. sulph.	2	Gm. or 3ss.
Ferri pyrophos.	8	Gm. or 3ij.
Spt. chloroformi	11	c.cm. or f3iij.
Glycerin.	q. s. ad 120	c.cm. or f3iv.

M. Sig.: Teaspoonful in a wineglassful of water four times a day.

In dyspnœa and shortness of breath attending emphysema, winter cough, or phthisis, strychnine is useful.

Dr. Thomas J. Mays advocates the employment of large doses of strychnine in bronchial and pulmonary disorders, until some evidence of its physiological action is manifested. Strychnine is of value also in maintaining respiration in narcotic poisoning, as from opium. Nux vomica is of considerable value in the treatment of phthisis. By promoting digestion it maintains nutrition. It relieves the vomiting to which consumptive subjects are liable, and, as Murrell has shown, has some power to check night-sweats. When given with the latter object in view, it is best combined with aromatic sulphuric acid. Pinnoy has reported good results from the hypodermic injection of strychnine arsenate in four cases of phthisis; 0.24 to 1 c.cm. (or *m*iv-xv) of a ½-per-cent. solution in liquid vaselin was given daily.[1] The same salt, administered by the mouth, has sometimes seemed of value in diabetes mellitus. L. Feilchenfeld reports marked reduction in the quantity of urine, when polyuria or diabetes insipidus is treated by hypodermic injections of strychnine nitrate, 0.005 Gm. (gr. 1/50) daily.

[1] "Annual of the Universal Medical Sciences," 1890, vol. v, p. A-96.

In amaurosis and failing eyesight the tincture of nux vomica may be administered, gradually increasing the dose and watching its effects in order to prevent toxic symptoms. Strychnine is especially beneficial in amaurosis caused by abuse of tobacco or alcohol. In delirium tremens, large doses of tincture of nux vomica are not only well borne, but are rapidly curative.

Strychnine is not to be used while acute neuritis exists, or during the period of vascular reaction after apoplexy. In hypertrophy of the heart it should be given cautiously. In neuralgia due to impaired nutrition we may employ:—

℞ Zinci phosphidi ..... | .006 Gm. or gr. $^1/_{10}$.
Ext. nucis vomicæ ..... | .015 Gm. or gr. $^1/_4$.
M. et ft. pil.
Sig.: To be taken every three or four hours.

In simple indigestion and atonic dyspepsia use:—

℞ Extracti nucis vomicæ ..... | .38 Gm. or gr. vj.
Quininæ hydrochlorat. ..... 1 | .55 Gm. or gr. xxiv.
Pulv. capsici ..... | .065 Gm. or gr. j.
Ext. gentianæ ..... 4 | Gm. or ʒj.
M. et ft. pil. no. xxiv.
Sig.: Take one or two before meals.

In tobacco-amaurosis de Schweinitz recommends:—

℞ Tr. nucis vomicæ ..... 7|5 c.cm. or fʒij.
Sig.: Take 3 drops three times daily, increasing 2 drops daily until physiological effects are obtained.

℞ Tr. nucis vomicæ,
Acid. nitrohydrochlor. dilut.,
Spiritus chloroformi .....aa 4 | c.cm. or fʒj.
Infus. gentianæ .....q. s. ad 180 | c.cm. or fʒvj.
M. Sig.: Take a tablespoonful or two after each meal for flatulent colic.

Strychnine sulphate, given hypodermically in doses of 0.0005 Gm. (or gr. $^1/_{120}$), is a very efficacious remedy in gastralgia and visceral neuralgia in general, as well as in the milder forms of angina pectoris. The same treatment has also been recommended for infra-orbital neuralgia. The tincture has been given with good results in those cases of chorea which arise about the age of puberty, and seem to have no connection with rheumatism, as well also in some cases of chorea major. In idiopathic epilepsy of ill-nourished patients, nux vomica will frequently afford a decided relief. Hæmatosis is promoted by nux vomica, and hence it is of value in the management of anæmia, chlorosis, amenorrhœa, and dysmenorrhœa. It is serviceable in purpura and in post-partum hæmorrhage. Dr. G. V. Hall and Dr. John Milton Duff have independently called attention to the value of strychnine in the late months of pregnancy and during labor. These writers advise its use in the case of women whose previous labors have been retarded, in those subject to severe after-pains, or in whom a history exists of post-partum hæmorrhage and subsequent subinvolution. On the other hand, even small doses of strychnine given during this period will cause some women to abort, and, as a rule, it should not be given for any length of time continuously to pregnant women. By promoting capillary circulation, it is beneficial in cases of habitual coldness of hands and feet. Strychnine aids in

overcoming subinvolution of the uterus. It is useful in some cases of spermatorrhœa and impotence.

ŒNOTHERA.—Evening Primrose (Onagra biennis, or Œnothera biennis, Nat. Ord. Onagraceæ) is a familiar herb; known also as "cure-all." A fluid extract is used in doses of 0.60 to 4 c.cm. (or *m*x-℥j) by the eclectics principally; but they also have a tincture and an infusion of the pressed leaves (also made by diluting the fluid extract). It is a sedative and alterative, probably diuretic. An ointment of œnothera is used in children's eczema. Evening primrose is useful in catarrhal affections, especially of the acute kind (in bronchitis, pertussis, gastro-enteritis, and dysentery). O. H. Rohde, of Brooklyn, praises its action in la grippe.[1]

OLEANDER. — Nerium oleander (Apocyanaceæ), an evergreen shrub, bearing handsome flowers, is a native of the country surrounding the Mediterranean.

Professor Schmiedeberg has found in oleander-leaves a glucoside, **Oleandrin,** and a second active substance which he has named **Neriin,** which he believes to be closely allied to, if not identical with, digitalin.

Physiological Action and Therapy.—The young twigs and the leaves of oleander are poisonous, and have proved fatal to children and adults. In a lethal case reported by King, of Bombay, the symptoms were burning pain beginning in the epigastrium and subsequently involving the whole body, unconsciousness, trismus, and convulsions. The pupils were widely dilated. A decoction of the leaves and bark is popularly used in the south of France as a lotion in various diseases of the skin. Dr. von Oefele has recently advocated the use of oleander as a *succedaneum* to digitalis in cases where the latter fails or is ill borne, and reports seventy-four cases of cardiac disease in which it was found advantageous. Its principal effect is said to be the diminution of the rapidity of the pulse. Oleander increases the blood-pressure and promotes the action of the kidneys. The influence upon the circulation continued, in some instances, as long as two weeks after cessation of administration. Oleander was given in the form of a 10-per-cent. tincture, in doses of 1.20 c.cm. (or *m*xx) three times a day. The fluid extract is a better preparation, in dose of 0.06 to 0.18 c.cm. (or *m*i-iij).

According to the writer quoted, oleander is useful in diseases of the kidney and myocardium and in atheroma. It is contra-indicated by the presence of vomiting or diarrhœa.

OLEUM BERGAMOTTÆ.—Oil of Bergamot.

Pharmacology and Therapy.—A volatile oil from the Citrus Bergamia (Aurantiaceæ), obtained by expression from the rind of the fresh fruit, which also contains **Bergaptene,** or bergamot camphor. The odor makes bergamot valuable in perfumery; and it probably has antiseptic and stimulating qualities, but is not used medicinally.

OLEUM CADINUM (U. S. P., B. P.).—**Oil of Cade.**

Pharmacology and Therapy.—Cade-oil is an oily product obtained from the Juniperus Oxycedrus (Pinaceæ or Coniferæ), the African, Spanish, or prickly cedar, or large brown-fruited juniper, a species of the Mediter-

[1] *Eclectic Review,* Nov. 15, 1903.

ranean region, quite similar to J. Communis and J. Sabina. Troeger and Feldmann[1] found **Cadinene** present only in small quantities, the chief constituent of the oil appearing to be a sesquiterpene, which was optically inactive and boiled at 250°-260° C. The oil of cade is useful as a stimulant application in chronic eczema and in psoriasis. In the latter malady, after the scales have been removed, Hebra's modification of Wilkinson's ointment often proves of considerable efficacy. The formula is as follows:—

℞ Sulphuris sublimati	15	5	Gm. or ʒss.
Olei cadini	15		c.cm. or fʒss.
Saponis viridis,			
Adipis	aa 31		Gm. or ʒj.
Cretæ preparatæ	10		Gm. or ʒiiss.

M. et ft. ungt.

The following mixture, which can readily be weakened if it proves too irritant, has also been recommended:—

℞ Olei cadini	420	c.cm. or fʒxiv.
Tr. quillajæ	37	c.cm. or fʒx.
Glycerit. amyli	473	c.cm. or fʒxvj.—M.

Gaucher[2] recommends a mixture of oil of cade in acetone collodion as having special advantages in psoriasis, lichenoid eczema, simple chronic lichen, nummular eczema, seborrhœic eczema, and in lichen planus. For patches of psoriasis, it is preferable to chrysophanic traumaticin. He recommends that only pure oil of cade from juniper and water-free acetone be used, otherwise the preparation will not adhere satisfactorily.

OLEUM CAJUPUTI (U. S. P., B. P.).—**Oil of Cajuput.**
Dose, 0.06 to 0.30 c.cm. (or *mi*-v).

Preparation.

Spiritus Cajuputi (B. P.).—Spirit of Cajuput (contains oil of cajuput, 5 c.cm., or *m*lxxv; alcohol, 50 c.cm., or fʒxiij). Dose, 0.30 to 1.20 c.cm. (or *m*v-xx).

Pharmacology.—"A volatile oil obtained by water or steam distillation from the fresh leaves and twigs of Cajuputi viridiflora (Myrtaceæ): a tree of the East Indies.

Physiological Action. — Locally it is rubefacient, antispasmodic, and antiseptic. Internally it is carminative, diaphoretic, and diuretic, and somewhat stimulating to the circulation. It is of a green color, and has a camphoraceous odor and neutral reaction.

Therapy.—Externally it has been used as a counter-irritant, usually diluted with sweet oil, in myalgia and chilblains, and in various parasitic affections, such as tinea, pityriasis, eczema, scabies, etc. Delvaux states that he has found oil of cajuput to be an efficacious application in psoriasis and rosacea. It may also serviceably enter into the composition of a stimulating ointment for alopecia. This oil has been successfully used, suitably diluted with an emulsion, as an injection for ascarides, or seat-worms. Diluted with glycerin or olive-oil it is a good local application in ear-ache. A drop of oil of cajuput upon cotton placed within the cavity of a carious tooth relieves toothache. This remedy has also been given internally as a vermifuge.

[1] *Arch. d. Pharm.*, 1898. 692.
[2] Congrès de la Société Française de Dermatologie et de Syphiligraphie, 1896.

The oil of cajuput has been used with advantage to relieve the prostration of typhoid fever. This remedy is of service in intestinal colic, cholera morbus, and nervous vomiting, and also relieves nervous dysphagia, hiccough, and dyspnœa, and it is said to allay the pain of dysmenorrhœa. Its principal use internally is for its stomachic effects as an adjuvant to tonic remedies. It has been administered in comparatively larger doses (1 to 4 c.cm., or *m*xv-lx) in the collapse stage of cholera, with good results. It is claimed to be useful in rheumatism and in various skin diseases. The **oil of niaouli** or miaouli, derived by distillation from the leaves of Melaleuca viridifloria, a large tree of New Caledonia, possesses properties very similar to those of the oil of cajuput. Niaouli-oil is of a pale-yellow color, has a taste which recalls that of peppermint, and is analogous in chemical composition to terpinol. It is soluble in alcohol, ether, and benzin. Niaouli-oil is well borne by the stomach and has been given in doses of 0.24 c.cm. (or *m*iv) in emulsion or capsule. It is said to have an excellent effect in bronchitis, and in pulmonary tuberculosis it markedly diminishes the expectoration. Niaouli-oil has also been used by Dr. Blanc in other conditions for which the oil of cajuput is given.

OLEUM CROTONIS (B. P.).—**Croton Oil.** (See **Oleum Tiglii**, U. S. P.)

OLEUM ERIGERONTIS (U. S. P.).—**Oil of Erigeron.**

Dose, 0.60 to 2 c.cm. (or *m*x-xxx).

Pharmacology.—"A volatile oil distilled from the fresh flowering herb of Leptilon Canadense," or Canada flea-bane (Compositæ). It is an amber-colored liquid, with slightly-pungent taste and characteristic aromatic odor, resembling that of turpentine. It has diuretic and hæmostatic properties. The fluid extract (alcoholic) is also used. Dose, 4 to 7.5 c.cm. (or f3i-ij).

Therapy.—The oil of erigeron is very efficient in cases of uterine hæmorrhage (metrorrhagia), especially when of passive character. Menorrhagia may likewise be checked by the inhibition of this remedy. It has also been used in controlling other hæmorrhages, such as epistaxis.

Hæmorrhage from the bowel is similarly arrested by the oil of erigeron. Erigeron is often an effective remedy in hæmoptysis. Dr. de Puy states that he has used this remedy with success in diarrhœa and dropsy, and it has proved successful likewise in dysentery.

This remedy may be given either simply dropped upon sugar, or in an emulsion.

OLEUM MORRHUÆ (U. S. P., B. P.). — **Codliver-oil (Oleum Jecorus Aselli).**

Dose, 4 to 15 c.cm. (or f3i-f℥ss).

Preparations.

Emulsum Olei Morrhuæ (U. S. P.).—Codliver-oil Emulsion. Dose, 8 to 15 c.cm. (or 3ii-iv).

Emulsum Olei Morrhuæ cum Hypophosphitibus (U. S. P.).—Codliver-oil Emulsion with hypophosphites. Dose, 8 to 15 c.cm. (or 3ij-iv).

Pharmacology.—"A fixed oil, obtained from the fresh livers of Gadus Morrhua, and of other species of Gadus (class, Pisces; order, Teleostia; family, Gadida)" (U. S. P.), "the oil extracted from the fresh liver of the

cod, Gadus Morrhua, by the application of a temperature not exceeding 180° F.; and from which solid fat has been separated by filtration at about 23° F. (B. P.). It is usually a colorless, or straw-colored, thin, oily, liquid, consisting chiefly of **Olein**, with characteristic alkaloidal and acid, fatty principles. The best oil is got from the Lofoten Islands, Norway, from our New England coast, Nova Scotia, and Newfoundland. It contains a peculiar principle named **Gaduin**, with **Trimethylamin**, and traces of iodine, bromine, phosphoric and sulphuric acids, and biliary salts. Good oil should not have a strong, fishy smell or taste; should not deposit much granular fat at 32° F., and should, when treated with sulphuric acid, give a violet color-reaction, changing to brownish red. If 1 drop of the oil be dissolved in 20 drops of carbon disulphide, and the solution shaken with 1 drop of sulphuric acid, it will acquire a violet-blue tint, rapidly changing to rose-red and brownish yellow. Contact with nitric acid and oil produces a red color; on stirring with a glass rod the color becomes a bright rose-red, rapidly changing to lemon yellow. Gautier and Mourgues in 1888, in codliver-oil, found several new alkaloids, butylamine, amylamine, oxylamine, dihydrobutylamine, oxycollidine, nicomorrhuine, dihydrolutidine, aselline, and morrhuine, besides an unstable, fatty substance, morrhuic acid, containing phosphorus and resembling lecithin.

From the study of sections of the fresh liver of the cod by J. Bouillot, however, it would appear that the alkaloids found in codliver-oil exist in the hepatic tissue normally, as he detected crystals of the alkaloids by the use of the microscope.

These alkaloids—or, at least, some of them—are now being prepared for medicinal use, and the following free bases and salts can be obtained: Amyline, with its hydrochlorate, hydrobromate, and bitartrate; dihydrolutidine, with its bitartrate; oxycollidine and its hydrochlorate; nicomorrhuine and its hydrochlorate: and morrhuine.

Under the name of **Gaduol**, or **Morrhuol**, M. Chapoteaut has isolated these principles, in the form of an amber-brown, bitter, aromatic liquid, partially crystallizing at a low temperature, and consisting of the free oleic acid of the oil, alkaloids, and the fatty combinations with sulphur, iodine, bromine, and phosphorus. Thus, morrhuol represents the medicinal value of codliver-oil in very much reduced bulk. The usual dose of morrhuol is 1 or 2 capsules, each containing 20 c.cm. (about *m*iiiss) taken with or immediately after meals. Children take 2 to 4 daily and adults 6 to 8 daily. Capsules of morrhuol creosoté may also be obtained (each containing 3 $^1/_2$ minims of morrhuol and 1 minim of pure beech-wood creosote).

Physiological Action.—Externally, codliver-oil acts as a bland oil without causing irritation, and is even instilled into the eye by oculists. Its fishy smell is an objection to its use by inunction, and yet in infants this is such a valuable method of introducing it into the blood that the objection is overlooked. Applied to the surface in fevers, it reduces bodily temperature. Internally, in doses suited to the powers of assimilation, it increases the appetite and improves nutrition, enhances the number of red blood-corpuscles, stimulates healthy cell-formation, and exerts an alterative effect. Morrhuol, not being fatty (to the same extent, at least), does not directly increase the bodily weight, but otherwise acts physiologically in the same manner as the oil. According to Gautier and Mourges, many of the alkaloids of codliver-oil, as butylamine, amylamine, and especially morrhuine,

together with morrhuic acid, stimulate the nervous system, promote tissue-change, cause a rapid increase of the urine and perspiration, and, proportionately, sharpen the appetite. In addition, the phosphorus exists in organic combination capable of being readily appropriated by young cells. The association of fatty bodies with biliary matter promotes absorption and assimilation. The properties of the iodine and bromine are also enhanced by the state of organic combination in which they exist.[1]

Bouillot has extended to the human subject the experiments made by Gautier and Mourgues upon animals. His researches confirmed those of the latter observers. The urea was greatly increased as well as the quantity of the urine. Analyses furthermore demonstrated that the augmentation of urea was due to a more complete oxidation of nitrogenous matter.

Erythema or acne is sometimes due to the prolonged use of codliver-oil.

Therapy.—In children suffering with marasmus, scrofula, chronic skin affections, tuberculosis, and wasting diseases generally, the use of codliver-oil by inunction daily, or several times a week, produces rapid improvement. The patient is stripped and the oil applied over the surface of the body, with the manipulations of massage, before a warm fire; a blanket is wrapped around him, which is to be kept on for an hour or two; the excess of oil is then removed by a warm bath containing a little whisky or bay-rum. In this way the child does not have such a disagreeable odor as when the oil is simply applied under its binder. In the cœliac affection of children, characterized by suspension of function of the pancreas, this method is particularly applicable, and is absolutely necessary in order to keep up nutrition. In cases of whooping-cough similar inunctions to the chest are very serviceable. These inunctions are likewise valuable in the case of children exhausted by chronic diarrhœa, and of adults who suffer with chronic dysentery and scaly skin diseases. The daily inunction of codliver-oil is of some service in reducing the susceptibility to taking cold. The local application of this agent is useful in chronic rheumatism and rheumatoid arthritis. The internal administration or external use of codliver-oil is advisable in rachitis and laryngismus stridulus. As an internal remedy it is sometimes effective in habitual constipation in children. This oil has been used with advantage in diabetes mellitus characterized by great debility, and is especially indicated if it is associated with pulmonary tuberculosis.

Codliver-oil is used internally as a nutrient as well as a medicine. Its value is most marked in chronic disorders attended by malnutrition, in phthisis, chronic pulmonary processes, rheumatic affections, rheumatoid arthritis, and atheroma. It is also very useful in nervous affections, chorea, neuralgia and epilepsy, in syphilitic and strumous cachexia, and various eruptions upon the skin due to them. In convalescence from many diseases codliver-oil is an easily-assimilated form of nourishment. Chronic gout is ameliorated by the administration of codliver-oil. In chronic bronchitis it is of service, facilitating expectoration and promoting the nutrition of the diseased membrane. It is also a valuable remedy in emphysema. Codliver-oil is indicated in caries or necrosis of bone due to tuberculosis. In neurasthenia it may be given with advantage. The exhibition of this remedy is of especial utility in many cases of convalescence from measles or scarlatina.

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[1] *Annales de Thérapeutique Médico-Chirurgicales*, March, 1890.

In pannus and chronic conjunctival affections, codliver-oil has been instilled into the eye with good results.

Bouillot found that the administration of the alkaloids of codliver-oil was of decided benefit in the treatment of amenorrhœic and neurasthenic girls, feebly-nourished children, and old persons suffering from chronic bronchitis. They were well borne by those who were unable to take the oil.

Special Forms.—There can be no question that the digestibility of the oil is increased by mechanical and chemical conditions, as when given in the form of a good emulsion (not a soap, but a minute subdivision of fat-globules in a mucilaginous medium, resembling milk), and by the addition of pancreatin, and also by association with certain restorative agents, like the hypophosphites or calcium lactophosphate. The immense demand for these emulsions, stimulated by judicious advertising, has led to a very large production and much competition among manufacturing pharmacists to supply the requirements of the physician and patient. In manufacturing on a large scale, cost is carefully estimated, and the result in many cases is that an inferior grade of oil is used. Physicians frequently order an extemporaneous emulsion made with the best oil by responsible pharmacists, or instruct patients how to make it (white of egg, pancreatin, oil, and, if desired, a little whisky or Jamaica rum, stirred with an egg-beater or simply shaken together in a bottle, make a very acceptable preparation). The following combination has been recommended: To the juice of 7 lemons add 6 fresh-laid eggs, shells and all, and beat them together thoroughly. Allow them to stand in a cold place for four days, and then add a pint of codliver-oil and half a pint of Jamaica rum. This mixture is well shaken and then strained through muslin; a tablespoonful may be given three or four times a day. A serviceable emulsion for children is made by rubbing together codliver-oil and extract of malt (or maltine), equal parts. Gubb maintains that codliver-oil forms a solution with aqueous extract of malt, and that this combination is the most efficient means of disguising the taste of the oil. If there are fishy eructations, liquid pancrobilin may be given with the oil, or liquor pancreaticus, which will emulsify the oil and favor its absorption. It is better sometimes to give the oil before meals, to avoid eructations.

A 50-per-cent. emulsion may readily be made by rubbing together 8 parts of the oil with 3 parts each of condensed milk, and glycerin, or syrup, and 2 parts of water. A few drops of oil of bitter almond or wintergreen render the mixture more palatable. A codliver-oil jelly may be prepared by soaking 5 parts of gelatin in 30 parts of water for a few hours, heating until dissolved, adding 30 parts of syrup, and finally 60 parts of codliver-oil, to which some flavoring oil has been added. The mixture should be stirred well and poured into wide-mouthed bottles or jars.

The following emulsions, containing codliver-oil will be found to be serviceable:—

℞ Olei morrhuæ,
Glycerini,
Syrup. hypophosphiti .....aa 120 | c.cm. or f℥iv.
Olei cinnamomi ..... | 60 c.cm. or *m*x.

M. et ft. emul. mist.

Sig.: A tablespoonful three times a day. Valuable for tuberculosis, debility, and chronic skin diseases, such as eczema, psoriasis, acne, and seborrhœa.

℞ Olei morrhuæ ..... 240 | c.cm. or fʒviij.
Liquor pancreatini ..... 60 | c.cm. or fʒij.
Pulveris myristicæ ..... 12 | Gm. or 3iij.
M. et ft. emul. mist.
Sig.: A tablespoonful just before meals. Use in debility and weak digestion.

℞ Olei morrhuæ,
Liquor calcis ..... aa 150 | c.cm. or fʒv.
Olei gaultheriæ ..... | 60 c.cm. or *mx*.
M. et ft. emul. mist.
Sig.: A dessertspoonful three times a day. Serviceable in scrofula, tuberculosis, and in chronic skin diseases.

℞ Olei morrhuæ,
Syrup. pruni Virg.,
Ext. malti ..... aa 120 | c.cm. or fʒiv.
M. et ft. emul. mist.
Sig.: A tablespoonful three times a day. Employ in debility, in diseases of the throat, and in chronic bronchitis and tuberculosis.

℞ Olei morrhuæ,
Spiritus vini Gallici,
Syrup. hypophosphitum comp. ..... aa 120 | c.cm. or fʒiv.
Ol. menth. pip. ..... | 60 c.cm. or *mx*.
M. et ft. emul. mist.
Sig.: A tablespoonful three times a day. For syphilis, scrofula, and chronic diseases.

℞ Olei morrhuæ ..... 120 | c.cm. or fʒiv.
Olei eucalypti,
Creosoti ..... aa | 60 c.cm. or *mx*.
Spiritus ætheris comp. ..... 30 | c.cm. or fʒj.
M. et ft. emul. mist.
Sig.: Two teaspoonfuls three times a day. Beneficial in tuberculosis and chronic tuberculosis.

The preliminary administration of an ethereal preparation, like Hoffman's anodyne or pure ether, in cold water will favor the digestion of the oil by stimulating the flow of the pancreatic fluid. An addition of 1 per cent. of oil of eucalyptus is said to make it more acceptable to the palate. It is a good plan to eat a slice of lemon after taking the plain oil, in order to remove the oily taste from the mouth. A piece of pickle before and after taking the oil is stated to produce the same effect. Numerous other methods have been suggested in order to conceal the taste of codliver-oil and aid its assimilation. Alcohol in some form is frequently used for this purpose. Washing the mouth out with brandy or whisky will partially obtund the sense of taste, so that a dose of oil may be quickly swallowed without exciting much sensation. The oil may be poured into the froth of beer in such a manner as not to touch the edge of the glass, or it may be taken in a hot punch. A few drops of chloroform will, it is said, disguise the taste. A little salt, taken just before and after the oil, has been recommended. Some prefer to take it in black coffee. It is stated that tomato-catsup covers the taste of codliver-oil, and that chewing smoked herring, or a sardine, accomplishes the same purpose. Others administer it in milk or in lime-water, to which a drop or two of some essential oil may be added. A formula given by Seig may effectually disguise the taste, while the odor of the mixture resembles that of roasted meat:—

℞ Olei morrhuæ	2070	c.cm. or f℥lxx.
Creosoti	2	50 c.cm. or *m*xl.
Saccharin.		17 Gm. or gr. iiss.—M.

The following combination is recommended by Eisenschitz for the purpose of disguising the taste of the oil:—

℞ Olei morrhuæ	90	c.cm. or f℥iij.
Saccharin.		25 Gm. or gr. iv.
Æther acetic.	2	c.cm. or f3ss.

M. Instead of the acetic ether, 2 drops of essence of peppermint or 1 or 2 drops of essence of cinnamon may be used.

Some patients prefer to take the oil before meals, and find the eructations do not occur, as when taken after eating. The mistake is generally made of giving it in doses larger than can be digested, with the result of disordering the stomach and even exciting diarrhœa. A ferrated codliver-oil is made by dissolving 10 parts of iron benzoate in 1000 parts of the oil, with the aid of gentle heat and frequent agitation. It is a clear, reddish-brown liquid. The oleate of quinine may be combined with it in any desired quantity.

An arsenical codliver-oil is prepared by warming 0.5 Gm. (or gr. viiss) of arsenous oxide with 20 c.cm. (or f3vss) of absolute alcohol in a small flask; the addition of a small particle of potassium carbonate causes solution of the oxide without itself undergoing any change. The solution, being filtered, is added to 1500 c.cm. (or Oiiif℥vj) of codliver-oil and warmed on a water-bath until the alcohol is dissipated. The oil is perfectly transparent, and the preparation can be administered to children in doses of $^1/_2$ to 1 teaspoonful.

OLEUM MYRCIÆ.—Oil of Myrcia, Oil of Bay.

Preparation.

Spiritus Myrciæ.—Spirit of Myrcia (bay-rum). External use.

Pharmacology and Therapy.—The oil of myrcia is a volatile oil distilled from the leaves of Pimenta acris (Myrtaceæ), or bay-tree, of the West India Islands. It contains **Eugenic acid** and a hydrocarbon. It is used only as a perfume. The spirit, or bay-rum, is an agreeable cooling application in fevers, headache, etc.

OLEUM NEROLI.—Oil of Neroli, Volatile Oil of Orange-flowers. The oil of neroli is distilled from the flowers of Citrus aurantium and Citrus vulgaris (Aurantiaceæ). Dissolved in alcohol (2 per cent.) it forms the spirit of neroli, used for flavoring. The oil of neroli is obtained in the distillation of orange-flower water, but is not the same volatile oil as that contained in the water (see **Aqua Aurantii Florum**), and orange-flower water cannot be made from the oil of neroli.

OLEUM OLIVÆ (U. S. P., B. P.).—**Olive-oil, Sweet Oil.**

Pharmacology.—Olive-oil is "the fixed oil expressed from the ripe fruit of Olea europœa (Oleaceæ)." It consists largely of **Olein** (more than two-thirds), with some solid fat, **Tripalmitin.** The best or virgin oil is obtained from the crushed ripe fruit, by expression without heat; a second quality is obtained by the addition of hot water to the same crushed fruit and ex-

pressing again. An inferior grade is made from the residue, after boiling, with the aid of very strong pressure. The best is nearly tasteless and without color, the second has more taste and color, and the third is dark and more or less rancid, with strong odor. The better varieties are used upon the table, as salad-oil, and also in pharmacy. Olive-oil enters into lead plaster and diachylon ointment. Cotton-seed oil and peanut-oil are used very largely as substitutes, but have not the agreeable flavor of olive-oil.

Physiological Action and Therapy. — Olive-oil is a lubricant and is added to poultices, as an emollient, in pneumonia and in skin diseases. Carbolized oil (1 to 24) is a valuable dressing for wounds. Internally, olive-oil is nutritious and laxative, and is a purgative for infants (in doses of a teaspoonful). During its use, the infant may pass lumps of white fat, resembling beans, composed of undigested tripalmitin. In adults, it is a useful remedy in all forms of irritant poisoning, except that by phosphorus; it is also a good enema. Given internally, in the dose of 15 to 30 c.cm. (or f℥ss-j), olive-oil will often relieve simple constipation in adults, especially when the condition has been produced by opium. It may be employed with advantage as a demulcent laxative in hæmorrhoids and fissure of the anus. Much has been written of late concerning the value of this oil in gall-stone and hepatic colic. It has been freely administered in large doses (90 to 180 c.cm., or f℥iii-vj) and was thought to aid in the expulsion of the concretions. While it seems to have some power to alleviate pain, it has no other influence, and the stones supposed to be passed during its use have been shown to be, in many cases, merely fatty masses.

Olive-oil, in doses increasing from 15 to 90 c.cm. (or f℥ss-iij), has been known to cause the disappearance of obstructive jaundice. Dr. Oliver reports one case in which jaundice had been present for ten months, but vanished within three weeks under the use of olive-oil. At the same time the general condition improved. The ingestion of a tumblerful or more of the oil during the day is an old treatment, recently revived, for lead colic. It is particularly advocated by Dr. Weill, of Lyons. It is stated that pain is relieved from the beginning of the treatment, that constipation begins to yield on the second or third day and is soon succeeded by diarrhœa. The free evacuation of the bowels is attended by the subsidence of the nervous manifestations.

The late Dujardin-Beaumetz expressed a favorable opinion of the action of olive-oil in hepatic colic, and remarks that failure constitutes the exception, that the large doses are well borne and do not cause vomiting. He was in the habit of combining ox-gall with the oil in the proportion of 1 part of the former to 10 parts of the latter. Rosenberg has experimentally demonstrated that olive-oil stimulates the secretion of bile and promotes its fluidity. This writer regards the bile as the immediate agent in the removal of calculi.

Olive-oil Injections.[1]—Herschell states that the methodical use of warm oil injections is one of the most useful procedures: (1) in cases depending upon chronic mucomembranous colitis; (2) in constipation associated with spasm of the bowel such as frequently occurs in neurasthenia; and (3) to secure a daily action of the bowels in atony of the intestines. Three to ten ounces of warm olive-oil should be injected into the rectum at

[1] *Lancet*, October 1, 1904.

bed-time. This is retained over night and causes an evacuation the following morning. The oil must be given, slowly and easily, so as not to cause an immediate evacuation. It is best given from a large glass funnel suspended a few feet above the patient, and through a rubber tube and nozzle of large calibre. When the oil is insufficient it may be supplemented by a small water injection in the morning for a few days. After two or three weeks the oil need only be given on alternate nights.

In typhoid fever Dr. Owen F. Paget has used olive-oil by rectal injection, with good results. Reduction of temperature was noted and intestinal complications were wanting in his cases; diarrhœa was not a contra-indication, but rather an indication for its use, according to this writer. The quantity used was 473 c.cm. (or Oj) once daily, the same to be retained from twelve to twenty-four hours.

In scarlatina and other febrile affections, the application of oil to the skin reduces the temperature. In the desquamative stage of scarlatina it is of prophylactic utility by restraining the dispersion of scales through the atmosphere. Olive-oil has likewise been used by inunction in wasting diseases, and is of undoubted service, though of less value than codliver-oil. In a case of extreme weakness and emaciation due to malignant stricture of the œsophagus, Caird practiced intramuscular injections of sterilized olive-oil. It is stated that considerable benefit resulted from this procedure, and it is suggested that other conditions might be advantageously treated in the same manner.

Insects, which occasionally find their way into the external auditory meatus, may be easily removed by dropping a small quantity of this oil into the canal. The late Dr. C. R. Earley administered sweet oil freely in cases of snake-bites, and said that it had never failed in his hands. According to Dr. Cérenville, of Lausanne, the injection of 2 c.cm. (or *m*xxx) of sterilized olive-oil in obstinate and painful cases of dry pleurisy is of value by imitating Nature in providing a lubricating fluid. The oil is thrown into the pleural sac, the site of injection being the spot where friction-sounds are most distinctly heard.

A **white emulsion** is made by rubbing up powdered gum acacia (20 Gm., or gr. cccviij) with olive-oil (90 c.cm., or f℥iij), and when thoroughly mixed gradually adding orange-flower water and syrup (of each, 60 c.cm., or f℥ij). It is used, either alone or in combination with opium, in treating dysentery, tenesmus, irritation of the bowels, etc.

Lipanin is an artificial mixture, intended as a substitute for codliver-oil. It was devised by von Mering, and consists of 6 parts of oleic acid to each 100 of olive-oil. It is free from disagreeable odor and taste, and is readily emulsified and easily digested; it may be given with calcium and sodium hypophosphites (0.65 Gm., or gr. x, of each) several times a day. Galatti[1] finds lipanin palatable and well borne by children; under its use they increase in weight and appetite, but the tuberculous process does not seem to be influenced by it. It costs more than codliver-oil.

Von Mering has also prepared a mixture known as tonic chocolate, which consists of chocolate to which oleic acid has been added, and may be used to some extent to take the place of codliver-oil.

Another proposed substitute for codliver-oil and which has the merit of palatability consists of linseed-oil, together with ferric hypophosphite, oil of

[1] "Annual of the Universal Medical Sciences," 1890, vol. v, p. A-88.

eucalyptus, oil of gaultheria, Irish moss, marshmallow, glycerin, and diluted hydrocyanic acid.

The alkaloids, or active principles of codliver-oil, are administered in pill form, or in combination with wine, or tonic remedies, in the treatment of phthisis and other wasting diseases.

OLEUM PINI (B. P.).—**Oil of Pine.**

Dose, 0.30 to 0.60 c.cm. (or *m*v-x).

Pharmacology and Therapy.—An oil is distilled from the fresh leaves of Pinus Pumilio, growing on the mountains of Switzerland, Austria, and Hungary. The oil is nearly colorless, having a pleasant aromatic odor and pungent taste. According to the investigations of Schimmel, oil of pine contains **lævo-pinine** and lævo-phellandrene, also notable quantities of esters of borneol, such as **borneol-acetate.**

In the German spas pine-oil is the most potent agent in the celebrated "pine-cure" treatment for catarrhal affections of the respiratory tract, as well as in the treatment for pulmonary tuberculosis; in the former conditions the oil may be used by inhalation, and in the latter this treatment may be enhanced by administering it internally in the form of capsules of 0.30 to 0.60 c.cm. (or *m*v-x) three times daily. It may be added to a steam or vapor bath (pine-needle bath), for rheumatic pains, or chronic joint-affections.

OLEUM RICINI (U. S. P., B. P.).—**Castor-oil.**

Dose, 4 to 30 c.cm. (or f℥j-℥j).

Preparation.

Mistura Olei Ricini (B. P.).—Castor-oil Mixture (castor-oil, 75 c.cm.; mucilage of acaciæ, 37.5 c.cm.; orange-flower water, 25 c.cm.; cinnamon-water, 62.5 c.cm.). Dose, 30 to 60 c.cm. (or f℥i-ij).

Pharmacology.—Castor-oil is "a fixed oil, expressed from the seeds of Ricinus communis" (Euphorbiaceæ), cultivated largely as an ornamental plant in our gardens, coming originally from India. The oil should be obtained without heat simply by crushing and pressing the seeds. It consists mainly of ricinoleic acid, combined with the base glyceryl as **Ricinoleate of glyceryl,** together with other fixed oils, a resin, and possibly an alkaloid, **Ricinine** (not purgative), and an acrid, drastic principle. It is a colorless, rather viscid, oily liquid, of faint, peculiar odor, and a bland, nauseating, acrid taste. It is soluble in an equal part of alcohol. It is a good addition to liniments on account of its density, and enters into the compound liniment of mustard and flexible collodion. Castor-oil is completely soluble in absolute alcohol, which is employed as a test for the detection of impurities. Pure castor-oil dissolves in spirit of 0.838 specific gravity at a temperature between 38° and 43° C. (100.4° to 109.4° F.), while foreign oils only dissolve at a considerably higher degree.[1] According to the investigations of H. Meyer, the purgative properties are due to pure ricinoleic acid and its glyceride, the ricinoleates of calcium and barium, and ricineloidic acid. Castor-oil is soluble in ether. The seeds from which it is expressed contain a highly irritant principle termed ricin, which renders them poisonous, and three seeds have been known to occasion fatal gastro-enteritis in a man.

[1] J. Arthur Wilson, in *American Journal of Pharmacy,* Dec., 1890.

Physiological Action.—When applied to the skin no irritation results. It is also very well borne by the conjunctiva, acting as a protective and sedative. The nauseating taste is largely due to its odor, and it can be taken much better if the nose be held during the act of swallowing. The odor may also be overcome by peppermint and other flavoring agents. As a purgative, it is classed as a laxative in small doses (0.60 to 4 c.cm., or *m*x-f℥j), becoming more active in full doses (15 to 30 c.cm., or f℥ss-j). The laxative effect results about four hours after administration. Castor-oil will sometimes have a purgative action when rubbed upon the abdomen of young children.

Therapy.—Castor-oil may be used as a menstruum to retain drugs in contact with the surface. The following is a suitable formula:—

℞ Olei ricini	15	c.cm. or f℥ss.
Alcoholis	60	c.cm. or f℥ij.
Tinct. cantharidis,		
Spiritus rosmarini	aa 30	c.cm. or f℥j.
Spiritus odorati	q. s. ad 240	c.cm. or f℥viij.—M.

A drop of castor-oil in the eye will often relieve the irritation caused by a particle of sand, or by granular lids. Dr. S. Mitchell has found a solution of cocaine in castor-oil to be an excellent application to corneal ulcer, relieving pain and healing the lesion after other solutions had been used in vain. Fomentations of the mammary glands with castor-oil plant leaves, wilted with hot water, are useful in promoting the secretion of milk. A fluid extract made from the leaves has been used in the same manner and also given by the mouth; a decoction has been employed in amenorrhœa.

Castor-oil as a purgative is useful in children, and in pregnant women, for piles or fissures of the anus, or after parturition, acting without any irritant effect, according to Brunton; but this is denied by Fordyce Barker, who, from clinical experience, declared that it is not suitable for such cases, and in pregnancy or after parturition aloes is a preferable purgative. Castor-oil is a good vermifuge, and should be given before and after the administration of other anthelmintics. In acute diarrhœa or dysentery, treatment should commence with 4 to 7.5 c.cm. (or f℥i-ij) of oil, combined with 0.30 to 0.60 c.cm. (or *m*v-x) of laudanum. This removes irritating substances and soothes the intestines. Dr. Young, of Florence, has successfully treated acute diarrhœa with small doses of castor-oil, and suggests the following formula:—

℞ Olei ricini	1|50	c.cm. or *m*xxiv.
Sp. chloroformi	6	c.cm. or f℥iss.
Morphinæ hydrochloridi	065	Gm. or gr. j.
Pulv. acaciæ	10	Gm. or ℥iiss.
Syr. simplicis	15	c.cm. or f℥ss.
Aquæ	q. s. ad 120	c.cm. or f℥iv.

M. Sig.: A dessertspoonful every hour and a half for an adult.

Phillips, also, has found the above mixture efficacious. In chronic dysentery, Brunton recommends 1 c.cm. (or *m*xv) of castor-oil with 0.30 to 0.60 c.cm. (or *m*v-x) of tincture of opium, given three times daily, or used thus:—

℞ Ol. ricini	2	c.cm. or f℥ss.
Tinct. opii	60 to 2	c.cm. or *m*x vel xxx.
Syr. sarsaparillæ vel		
Aquæ menth. pip.	45	c.cm. or f℥iss.
Pulv. acaciæ	q. s.	

M. Sig.: One or two teaspoonfuls three or four times a day.

In neuralgias, especially those affecting the trifacial nerve, Dr. Harold N. Moyer, of Chicago, has found castor-oil remarkably efficacious. He gives a single dose of 30 to 60 c.cm. (or f℥i-ij), usually in a little Bass's ale. In some cases this is given each morning before breakfast, with marked relief from the pain. He advises, also, washing the oil by shaking it with cold water, when it has become old and perhaps a little rancid, or disagreeable to the taste.[1]

A teaspoonful of oil will greatly relieve an infant suffering with acute bronchial catarrh.

Special Forms for Administration.—It may be given in soft capsules, which can be obtained of any size from 0.60 to 15 c.cm. (or *m*x-f℥ss). If the oil be given the first thing in the morning, an hour before breakfast, 0.60 to 1.20 c.cm. (or *m*x-xx) are generally sufficient to open the bowels. This dose may be given in a teaspoonful of peppermint-water and brandy, the proportion being such that the oil neither sinks nor swims in the mixture.[2] Some patients take oil readily when mixed with a little whisky, or coffee-syrup. It may be followed by a piece of cracker, or a gum-drop, to prevent eructations. Lemon- or orange- juice, coffee, froth of porter or beer, are also used as vehicles, but the best is the extemporaneous dose prepared at the soda-water fountain. It is stated in Merck's Reports that castor-oil may be made palatable by employing the following formula:—

℞			
Saccharin.		75 Gm.	or gr. xij.
Olei gaultheriæ	1	20 c.cm.	or *m*xx.
Alcoholis	15	c.cm.	or f℥iv.
Olei ricini	473	c.cm.	or Oj.

The following mixture is recommended by a contributor to the *American Druggist*.[3] In it the disagreeable taste of the oil is replaced by a pleasant flavor of almonds:—

Castor-oil	30 parts.
Bitter almonds	2 parts.
Sugar	30 parts.
Gum tragacanth.	½ part.
Orange-flower water	10 parts.
Water	120 parts.

The only drawback to this mixture is that a good deal of it is required for a dose, a teaspoonful of the oil being contained in about five teaspoonfuls of the mixture. The taste of codliver-oil is tolerably well disguised by highly-seasoned beef-tea. R. R. Mitchell advises for the same purpose a mixture of equal parts of the oil, aromatic syrup of rhubarb, and cascara cordial. Dr. Wabah McMurray, of Sydney, Australia, says, to disguise the unpleasant taste of castor-oil, a good idea is to ask the patient to take some cream in the mouth and apply it with the tongue over the entire surface. This prevents the oil from adhering to the mucous membrane. The taste is said to be disguised by hot milk, 1 part of the oil being shaken up with 4 of the milk. In children with griping diarrhœa and green stools contain-

[1] *Journal of the American Medical Association*, April 21, 1900, p. 981.
[2] Brunton's "Pharmacology, Therapeutics, and Materia Medica," 1885, p. 938.
[3] *Boston Medical and Surgical Journal*, Feb. 12, 1891, p. 175.

ing casein, to disguise the taste of the oil and act well, Dr. McMurray recommends the following combination:—

℞ Ol. ricini	4	c.cm. or f3j.
Mucil. acaciæ	q. s.	
Tinct. opii	30	c.cm. or *m*v.
Aquæ menth. pip. vel		
Aquæ chloroformi	60	c.cm. or f3ij.

M. Sig.: A teaspoonful every four hours.

A formula for a palatable castor-oil is thus given by N. J. Pritzker:—

℞ Ol. ricini	90	c.cm. or f3iij.
Vitellum ovi.		
Ol. amygdal. amar.	12	c.cm. or *m*ij.
Lactis recentis q. s. ad	120	c.cm. or f3iv.

The oil should be added slowly to the egg-yolk, triturating thoroughly, and the other ingredients are afterward added. The mixture can be taken in milk, syrup, or wine. The taste may also be masked by mixing the oil with an equal part of glycerin and adding a drop or two of the oil of cinnamon or of gaultheria to each dose. According to a method devised by Toellner and Bergmann, the finest castor-oil is repeatedly treated with hot water, sweetened with sufficient saccharin to give it the flavor of syrup, and the last trace of its original taste disguised by small quantities of oil of cinnamon and essence of vanilla.

OLEUM RUTÆ.—Oil of Rue.

Pharmacology.—Oil of rue is a volatile oil distilled from Ruta graveolens (Rutaceæ, Ruteæ). Its color is light yellow, which becomes brown when the oil is long kept; the taste is sharp and bitter; the odor is aromatic, disagreeable, and distinctive. This oil is soluble in all proportions in absolute alcohol. The oil is obtained from the leaves, which also contain a yellow coloring matter called rutin, a crystalline substance, possessing acid properties; also methyl nonyl ketone, methyl heptyl ketone, and lauric aldehyde.

Physiological Action.—Applied to the skin, oil of rue occasions hyperæmia, inflammation, and vesication. In ordinary doses it is carminative, and is a general stimulant to the circulation and the secretions. Large doses cause gastro-enteritis, convulsions, stupor, dimness of vision, contracted pupils, suppression of urine, or strangury. Abortion may follow toxic doses. It has a special action on the genito-urinary tract. Rue is eliminated and may be recognized by its odor in the breath, urine, and perspiration.

Therapy.—The oil of rue is useful in amenorrhœa due to defective excitement of the ovaries, and in passive menorrhagia of debility or following abortion. Hysteria, especially when associated with amenorrhœa, is benefited by this remedy. It has been used with success in flatulence and infantile convulsions dependent upon that condition. Used as an abortifacient, in accordance with popular reputation, it has several times caused death from irritant poisoning, as above indicated. Rue is beneficial in defective activity of the sexual organs, acting as an aphrodisiac and as an emmenagogue. The irritant properties of the oil of rue have caused it to be sometimes used as a topical remedy. It is said to have the power of destroying warts. Phillips states that the bruised leaves of rue laid upon the forehead will often check epistaxis. Rue has been added to liniments for application to the chest in

chronic bronchitis. A decoction of the fresh leaves may be employed as an injection to destroy ascarides. Rue has also been given internally in order to expel round-worms.

OLEUM SANTALI (U. S. P., B. P.).—**Oil of Santal, Oil of Sandal-wood.**
Dose, 0.30 to 2 c.cm. (or *m*v-xxx) in emulsion or capsules.

Pharmacology.—"The volatile oil distilled from the wood of Santalum album (Santalaceæ), of India, yielding, when assayed by the official process, not less than 90 per cent. of alcohols, calculated as santalol (U. S. P.). It is a pale-yellowish liquid, of a strongly-aromatic odor, a pungent and spicy taste, and slightly acid reaction. It is readily soluble in alcohol, ether, and chloroform, and is used in perfumery. Sandal-wood oil is not infrequently adulterated with some fixed vegetable or mineral oil, the essential oil of cedar or copaiba. The fixed oils may be detected by their lighter specific gravity and by the fact that if fixed oil be present it will not volatilize, but will leave a permanent stain when placed upon a piece of unsized paper. The essential oils are most surely recognized by the polarimeter, as they diminish the rotatory power of the sandal-wood oil.

Another method for detecting adulteration is given by M. E. Mesnard. The addition of pure sulphuric acid to unadulterated oil produces a viscid liquid, which soon thickens into a solid mass, of a light grayish-blue or grayish color, and adheres to the glass. If the oil is impure the resinous mass does not entirely solidify and remains of a deep tint with a distinct lustre.

Physiological Action.—Sandal-wood oil acts as an internal antiseptic and as an astringent to mucous surfaces, checking secretions and causing dryness of the throat and thirst. It is largely excreted by the kidneys and imparts an odor to the urine, to which it gives also medicinal qualities, so that it acts upon the urinary passages. Absorption and elimination are very rapid, and it may be detected in the urine half an hour after administration. This oil partly escapes by the broncho-pulmonary mucous membrane, and here also exerts a local effect. Dr. S. Rosenberg observed, after daily doses of 4 c.cm. (or f3j), irritation of the alimentary canal and urethra, with an eruption of small red papules upon the skin and conjunctiva.

Therapy.—Sandal-wood oil is used principally in the treatment of gonorrhœa, even in the acute stage, given in capsules of 0.30 c.cm. (or *m*v) each, one or two, three times daily. It seems to be best adapted to plethoric individuals, with abundant discharge. It generally relieves the pain and discharge within four or five days. If the discharge is not materially diminished within ten days the doses should be cautiously increased. The use of the oil is not contra-indicated by the presence of any of the complications of the disease. It is also valuable in pyelitis, cystitis, gleet, urethral hæmorrhage, and chronic bronchial catarrh. Dr. Curtin, of Philadelphia, recommends oil of sandal-wood in the treatment of obstinate cough. He administers it with advantage in phthisis, catarrhal pneumonia, and influenza.

It is important to note that much of the oil of sandal-wood, especially in the form of proprietary capsules, is impure, and is adulterated with other oils. The French preparation, known as Santal Midy, prepared by Midy's process from freshly-felled Mysore sandal-wood, is a reliable preparation, put up in capsules of 0.30 c.cm. (or *m*v) each in the laboratory of Rigaud and Chapoteaut, Paris. The leading manufacturers of soft capsules in this country also employ an oil of good quality and therapeutical activity.

The advantage of pure oil of sandal-wood over copaiba and cubeb is that it does not nauseate or disturb digestion, and can be given with good results during the inflammatory stages of blennorrhœa or cystitis. The fluid extract, obtained from the S. citrinum, or yellow sandal-wood, has been used for the same purposes as the oil. The wood is largely used as an ingredient of incense, in China, in temple-worship, and is prized for its perfume.

OLEUM SESAMI. —**Oil of Sesamum, Benne or Teel Oil.**

Pharmacology and Therapy.—"A fixed oil expressed from the seed of Sesamum indicum" (Pedaliaceæ). It is similar to cotton-seed oil, bland, inodorous, or nearly so, neutral in reaction, rich in olein, and is said to keep better than olive-oil. In large doses it is laxative, and emmenagogic properties have been attributed to it without much foundation. The seeds are used as food by the negroes of the South.

OLEUM SINAPIS VOLATILE (U. S. P., B. P.).—**Volatile Oil of Mustard.** (See **Sinapis.**)

OLEUM TEREBINTHINÆ (U. S. P., B. P.).—**Oil of Turpentine.** (See page 881.)

OLEUM TIGLII (U. S. P.), **OLEUM CROTONIS** (B. P.).—**Croton-oil.**
Dose, 0.015 to 0.12 c.cm. (or *m* $^{1}/_{4}$-ij).

Preparation.

Linimentum Crotonis (B. P.).—Liniment of Croton-oil. (Croton-oil, 20 c.cm.; oil of cajuput, 70 c.cm.; alcohol, 90 per cent., 70 c.cm.)

Pharmacology.—Croton-oil is "a fixed oil expressed from the seed of Croton Tiglium" (Euphorbiaceæ): an East-Indian tree. It is a pale-yellow, or brownish-yellow, rather viscid, and slightly fluorescent liquid, having a somewhat fatty odor, a mild oily, afterward acrid, burning taste. It is only partially soluble in alcohol, about 60 per cent. will dissolve when fresh, but the solubility and therapeutic activity increase by age. It is freely soluble in ether, chloroform, carbon disulphide, olive-oil, and oil of turpentine. It contains **Tigliic acid** (methyl crotonic, or crotonolic, acid), and also several glycerides of fatty acids. It contains a vesicating principle and a purgative principle. Alcohol dissolves about 20 per cent. of this oil, which carries with it the vesicating principle; the purgative constituent remaining in the insoluble portion.

Physiological Action.—The topical application of croton-oil to the skin causes irritation, inflammation, and a papular eruption, subsequently becoming pustular. Occasionally its application produces a general papulo-pustular eruption, scattered over the body. The pustules afterward dry up, and may give rise to scars if the oil is applied undiluted. The pustules are sometimes umbilicated, and, upon careless examination, the eruption might be mistaken for that of small-pox. When 1 or 2 drops of croton-oil have been swallowed vomiting may be produced, but in the course of an hour or two copious watery stools are passed, with symptoms of irritant poisoning, particularly when larger doses have been taken. Congestion of the gastro-intestinal tract occurs, and death may ensue from resulting inflammation of the bowels or peritonitis. Part of the oil diffuses into the blood, and produces glandular hyperæmia, and possibly an eruption upon the skin. Some-

times, when applied to the skin, the contrary is observed, the remedy passing through into the blood and causing watery discharges from the bowels. When combined with an alkali, or with some other agents, while it promotes the peristaltic action, the effects are more manageable and there is less danger of general toxic effects. It is a feeble hepatic stimulant according to Rutherford. The toxic effects of croton-oil are combated by means of demulcent drinks and opiates.

Therapy.—Croton-oil was formerly a favorite method of exciting counter-irritation, because it was convenient, simple, and rapid in its effects. On account of the danger of producing suppuration and the resulting scars, it is rarely resorted to at present. If it be diluted with 3 parts of oil of sweet almonds it is a little less prompt, but the resulting inflammation is much milder, and several applications are sometimes required in order to bring out sufficient papules. It is valuable in disease of the chest, in incipient phthisis, pleurisy, bronchitis, neuralgia, rheumatism, and glandular swellings. Sciatica, in particular, has been benefited by this method.

Counter-irritation by croton-oil is likewise serviceable in chronic laryngitis, ovaritis, and metritis, and in phlegmonous pharyngitis, especially of the relapsing variety, frictions of the upper part of the neck with croton-oil are strongly advised by Dr. Helbing. Dr. Charles Cobb states that half a drop of croton-oil applied daily by means of a probe is an excellent remedy in suppurative tonsillitis. Pustulation of the shaven scalp was formerly esteemed beneficial in meningitis, but is a method of treatment scarcely to be advocated. Its use in ringworm induces an artificial kerion, which soon subsides and the disease disappears. It should not be used for this purpose in delicate children, especially those under six or seven years of age; it should also be applied to a small spot, a little larger than a dime, and it should be used only in chronic cases.

The liniment of croton-oil, official in the British Pharmacopœia, may cause too much irritation, and can be diluted with advantage; for instance, 0.30 c.cm. (or *m*v) of this preparation to 30 c.cm. (or f℥j) of olive-oil is a stimulant application sometimes used in alopecia. In other cases of skin affection, occasional small doses of croton-oil, given in pill, usually in combination, are useful in clearing the alimentary canal.

Internally croton-oil is used as a drastic purgative in cerebral affections, apoplexy, etc., acute mania, and in cases of injury to the head. It is serviceable on account of its depletory and derivative effect in uræmic coma. In comatose conditions the dose may be simply dropped upon the tongue, and two or three times the usual dose are required. It is a better plan, however, to dilute the oil with a little lard, butter, sweet-oil, or castor-oil. This medicament is valuable as an hydragogue cathartic in the treatment of anasarca, and in many cases where a complete evacuation of the bowels is desired, to bring about prompt diminution of arterial pressure and derivative action. In some instances it would be proper to give croton-oil in obstruction of the bowels from impaction of fæces, lead colic, or paralysis of the intestine. It may also be used as a vermifuge to expel tape-worms, but is so violent that the head is apt to be torn off and remain, unless an anthelmintic has been administered previously. Croton-oil should not be given to a pregnant woman, nor to a patient subject to hæmorrhoids.

In doses of 0.008 to 0.01 c.cm. (or *m* $^1/_8$-$^1/_6$), in a pill with licorice, it makes an effective purgative, rarely rejected even in irritable conditions of

the stomach, and promoting both peristalsis and secretion, thereby softening and loosening masses which in the pouches of the colon may be retained for weeks undisturbed by the ordinary hydragogic purgatives. This remedy acts efficiently in dilatation and atony of the stomach where other remedies are not absorbed, and proves of great service in stercoræmia, which is at the root of many obstinate functional conditions, such as asthma, migraine, epilepsy, dyspepsia, and the effects of high arterial tension.

OLEORESINÆ ASPIDII (U. S. P.). (See **Aspidium**, page 237.)

OPIUM (U. S. P., B. P.).—**Opium.**
Dose, 0.015 to 0.13 Gm. (or gr. $^1/_4$-ij).

U. S. P. Preparations and Alkaloids.[1]

Opii Pulvis.—Powdered Opium (morphine, not less than 12, nor more than 12½ per cent.). Dose, 0.03 to 0.065 Gm. (or gr. ss-j).

Opium Granulatum.—Granulated Opium (same strength as powdered opium).

Opium Deodoratum.—Deodorized Opium (same strength). Dose, 0.03 to 0.065 Gm. (or gr. ss-j).

Extractum Opii.—Extract of Opium (morphine, 20 per cent.). Dose, 0.015 to 0.03 Gm. (or gr. $^1/_4$-ss).

Acetum Opii.—Vinegar of Opium (10 per cent.). Dose, same as Tincture.

Tinctura Opii.—Tincture of Opium, Laudanum (each 100 c.cm. contains 1.2 to 1.25 Gm. of morphine). Dose, 0.06 to 1.20 c.cm. (or *m*i-xx).

Tinctura Opii Deodorata.—Tinctura of Deodorized Opium (same strength as tincture). Dose, 0.06 to 1.20 c.cm. (or *m*i-xx).

Tinctura Opii Camphorata.—Camphorated Tincture of Opium, Paregoric Elixir (powdered opium, benzoic acid, and camphor, of each, 4 Gm.; oil of anise, 4 c.cm.; glycerin, 40 c.cm.; and diluted alcohol, q. s. ad 1000 c.cm.). Dose, 4 to 15 c.cm. (or f℥i-℥ss).

Vinum Opii.—Wine of Opium (10 per cent.). Dose, 0.30 to 1.20 c.cm. (or *m*v-xx).

Pulvis Ipecacuanhæ et Opii.—Powder of Ipecac and Opium, Dover's Powder (ipecac and opium, of each, 1 part; sugar of milk, 8). Dose, 0.65 Gm. (or gr. x).

Tinctura Ipecacuanhæ et Opii.—Tincture of Ipecac and Opium, Fluid Dover's Powder. Dose, 0.30 to 0.60 c.cm. (or *m*v-x).

Pilulæ Opii.—Pills of Opium (each, 0.065 Gm., or gr. j, powdered opium).

Trochisci Glycyrrhizæ et Opii.—Troches of Glycyrrhiza and Opium (each, 0.005 Gm., or gr. $^1/_{13}$, of powdered opium).

Mistura Glycyrrhizæ Composita.—Compound Mixture of Glycyrrhiza, Brown Mixture (paregoric, 12; antimonial wine, 6; sweet spirit of nitre, 3; extract of licorice, syrup, mucilage of acacia, and water). Dose, 4 to 15 c.cm. (or f℥i-f℥ss).

Emplastrum Opii.—Opium Plaster (extract, 6 per cent.).

Codeina.—Codeine. Dose, 0.015 to 0.13 Gm. (or gr. $^1/_4$-ij).

Codeinæ Phosphas.—Phosphate of Codeine.

Codeinæ Sulphas.—Sulphate of Codeine.

Morphinâ.—Morphine. Dose, 0.006 to 0.015 Gm. (or gr. $^1/_{10}$-$^1/_4$).

Morphinæ Acetas.—Morphine Acetate. Dose, 0.006 to 0.015 Gm. (or gr. $^1/_{10}$-$^1/_4$).

Morphinæ Hydrochloridum.—Morphine Hydrochloride. Dose, 0.006 to 0.015 Gm. (or gr. $^1/_{10}$-$^1/_4$).

Morphinæ Sulphas.—Morphine Sulphate. Dose, 0.006 to 0.015 Gm. (or gr. $^1/_{10}$-$^1/_4$).

Pulvis Morphinæ Compositus.—Compound Morphine Powder, Tully's Powder (morphine sulphate, 1.5 Gm.; camphor, 32 Gm.; glycyrrhiza (in No. 60 powder), 33 Gm.; precipitated calcium carbonate, 33.5; and alcohol, a sufficient quantity; then add the morphine by careful admixture). Each 0.065 Gm., or gr. j = 0.001 Gm., or gr. $^1/_{60}$, of morphine, and 0.02 Gm., or gr. $^1/_3$, of camphor. Dose, 0.13 to 0.65 Gm. (or gr. ii-x).

[1] Apomorphine hydrochloride (U. S. P., B. P.), dionin, and heroine, derivatives of morphine, are described in their appropriate alphabetical places.

B. P. Preparations and Alkaloids.

Extractum Opii.—Extract of Opium (morphine, 20 per cent.). Dose, 0.015 to 0.065 Gm. (or gr. $^1/_4$-j).

Extractum Opii Liquidum.—Liquid Extract of Opium (morphine, 0.75 Gm. in 100 c.cm.). Dose, 1 c.cm. (or *m*xv—equivalent to gr. ss of extract of opium).

Tinctura Opii.—Tincture of Opium, Laudanum (1 c.cm., or *m*xv, = 0.065 Gm., or gr. j, of opium). Dose, 0.30 to 1 c.cm. (or *m*v-xv) for repeated administration; single, 1.20 to 2 c.cm. (or *m*xx-xxx).

Tinctura Opii Ammoniata.—Ammoniated Tincture of Opium (contains 15 per cent. of tincture of opium). Dose, 2 to 4 c.cm. (or f3ss-j).

Tinctura Camphoræ Composita. — Compound Tincture of Camphor, Paregoric Elixir. Dose, 2 to 4 c.cm. (or f3ss-j).

Pilula Plumbi cum Opio.—Pill of Lead with Opium (lead acetate, 6 Gm.; opium, in powder, 1 Gm.; syrup of glucose, 0.7 Gm.), contains about 12 $^1/_2$ per cent. of opium. Dose, 0.13 to 0.25 Gm. (or gr. ii-iv).

Pilula Ipecacuanhæ cum Scilla.—Pill of Ipecacuanha with Squill (contains about 5 per cent. of opium). Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Pilula Saponis Composita.—Compound Pill of Soap (opium, 20 per cent.). Dose, 0.13 to 0.25 Gm. (or gr. ii-iv).

Unguentum Gallæ cum Opio.—Gall and Opium Ointment (gall ointment, 92.5 Gm.; opium in fine powder, 7.5 Gm.).

Linimentum Opii.—Liniment of Opium (equal parts of laudanum and of soap liniment).

Emplastrum Opii.—Opium Plaster (opium in powder, 10 Gm.; resin plaster, 90 Gm.).

Pulvis Ipecacuanhæ Compositus.—Compound Powder of Ipecacuanha, Dover's Powder (opium in powder and ipecacuanha, each, 1 part; potassium sulphate, 8 parts). Dose, 0.32 to 1 Gm. (or gr. v-xv).

Pulvis Cretæ Aromaticus cum Opio.—Aromatic Powder of Chalk with Opium (contains 2 $^1/_2$ per cent. of opium). Dose, 0.65 to 2.60 Gm. (or gr. x-xl).

Pulvis Kino Compositus.[1]—Compound Powder of Kino (contains opium, 5; kino, 75; cinnamon, 20 Gm.). Dose, 0.32 to 1.30 Gm. (or gr. v-xx).

Pulvis Opii Compositus.—Compound Powder of Opium (opium, 10 per cent., with black pepper, ginger, caraway-fruit, and tragacanth). Dose, 0.13 to 0.65 Gm. (or gr. ii-x).

Suppositoria Plumbi Composita.—Compound Lead Suppositories (each contains 0.2 Gm., or gr. iij, of lead acetate and 0.065 Gm., or gr. j, of opium).

Morphinæ Acetas.—Morphine Acetate. Dose, 0.008 to 0.03 Gm. (or gr. $^1/_8$-ss).

Morphinæ Hydrochloridum.—Morphine Hydrochloride. Dose, 0.008 to 0.03 Gm. (or gr. $^1/_8$-ss).

Morphinæ Tartras.—Morphine Tartrate. Dose, 0.008 to 0.03 Gm. (or gr. $^1/_8$-ss).

Codeina.—Codeine. Dose, 0.015 to 0.13 Gm. (or gr. $^1/_4$-ij).

Codeinæ Phosphas.—Codeine Phosphate. Dose, 0.015 to 0.13 Gm. (or gr. $^1/_4$-ij).

Liquor Morphinæ Acetatis.—Solution of Morphine Acetate (100 c.cm. contain 1 Gm., or *m*cx to gr. j). Dose, 0.60 to 4 c.cm. (or *m*x-3j).

Liquor Morphinæ Hydrochloridi.—Solution of Morphine Hydrochloride (same as preceding).

Liquor Morphinæ Tartratis.—Solution of Morphine Tartrate (same as preceding).

Trochiscus Morphinæ.—Morphine Lozenge (0.0018 Gm., or gr. $^1/_{36}$, in each).

Injectio Morphinæ Hypodermica.—Hypodermic Injection of Morphine (5 Gm. in 100 c.cm.). Dose, by subcutaneous injection, 0.12 to 0.30 c.cm. (or *m*ii-v).

Tinctura Chloroformi et Morphinæ Composita.—Compound Tincture of Chloroform and Morphine (each 10 minims contain, of chloroform, 0.045 c.cm., or *m* $^3/_4$; diluted hydrocyanic acid, 0.03 c.cm., or *m*ss; morphine hydrochloride, 0.005 Gm., or gr. $^1/_{11}$). Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Syrupus Codeinæ.—Syrup of Codeine (phosphate of codeine, 4.57 Gm. in 1000 c.cm., or gr. $^1/_4$ in each f3j). Dose, 2 to 7.5 c.cm. (or f3ss-ij).

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[1] The compound tincture of kino of the National Formulary contains 10 per cent. of laudanum. Each teaspoonful is equivalent to one-half a grain each of kino and powdered opium.

Suppositoria Morphinæ.—Morphine Suppositories (each contains 0.015 Gm., or gr. $^1/_4$, of morphine hydrochloride).

Papaveris Capsulæ.—Poppy Capsules. The nearly ripe dried fruits of Papaver somniferum (contain a small proportion of morphine).

Pharmacology.—Opium is "the concrete, milky exudation obtained by incising the unripe capsules of Papaver somniferum (Papaveraceæ), and yielding in its normal, moist condition not less than 9 per cent. of crystallized morphine when assayed by the U. S. P. process." "The juice obtained by incision from the unripe capsules of Papaver somniferum, inspissated by spontaneous evaporation" (B. P.). **Opium,** in its inspissated form, occurs in chestnut-colored masses or lumps, with an earthy, narcotic odor and bitter taste. In its commercial condition, as a moist, soft solid, it loses about 20 per cent. of its weight in the process of drying. When dried and powdered, the pharmacopœia directs that it shall contain not less than 12 nor more than $12^1/_2$ per cent. of morphine. The principal properties of crude opium are extracted by water, alcohol, and dilute acid, but not by ether. When a mass of opium is broken it should exhibit a notched fracture, and should leave an interrupted stain when drawn across white paper. Since all commercial opium contains more or less admixture of foreign material, or adulteration, the best preparation is the deodorized opium, obtained by dissolving and removing narcotine and other matters soluble in ether, and standardizing the product to the uniform strength of 14-per-cent. morphine. By employing deodorized opium in making Dover's powder a superior product is obtained, less disagreeable to the taste and less likely to cause nausea than that made from the ordinary powdered opium. A syrup of opium and ipecac may also be made with deodorized opium, so that each teaspoonful will represent 10 grains of Dover's powder. The preparations that pharmacy offers to the physician, of this ancient and valuable remedy, are innumerable, but they are all dependent for their activity upon the presence of certain proximate principles. It had been long suspected that a **vis dormitiva,** or narcotic element, existed in opium and gave it medicinal value, but it was not until 1817 that a crystalline body was isolated by Sertürner, which he correctly considered as the salt of an organic acid, to which he gave the name of **Meconic acid.** The sleep-producing principle he named morphium in honor of the drowsy god, but this has been since changed to **Morphine,** in order to make it conform in terminology to the other organic alkaloids of the pharmacopœia. Since then, other alkaloids and proximate principles have been separated from opium, some of which possess narcotic power, some have not, and one, at least, is a tetanizer resembling strychnine. The principal constituents and alkaloids are as follow:—

Morphine (at least 9 per cent. in crude opium) is the principal narcotic constituent. Codeine ($^1/_2$ per cent.); about half the narcotic strength of morphine, but more calmative. Narcotine (2 to 10 per cent.); no narcotic effects. Anarcotine, which is found especially in opium from India (and which was formerly used as a febrifuge, but the use of which is now abandoned), appears to be identical with Narcotine, and destitute of marked physiological properties. Thebaine, or paramorphine (less than $^1/_4$ per cent.); convulsive agent and spinal excitant. Narceine (0.02 per cent.); resembles morphine, but has less disagreeable after-effects. (A new and more soluble narceine has been prepared by Dr. Laborde and M. Duquesnel.[1])

[1] *Therapeutic Gazette,* Sept. 15, 1890, p. 639.

Papaverine (1 per cent.); narcotic and convulsant. Also cryptopine, pseudomorphine, protopine, cotomine, laudanine, codamine, rhœadine, meconidine, laudanosine, lanthopine, and gnoscopine in small amounts, with neutral principles,—meconin, meconoisin, and porphyroxin,—and meconic and lactic acids. **Morphine** crystallizes in the form of colorless, flat, six-sided prisms, destitute of smell, having a very bitter taste, which melt at about 330° F., and are destroyed by more elevated temperatures. Morphine is soluble in 5000 parts of cold water and 6148 ether; but is sparingly soluble in boiling water, freely soluble in alcohol and chloroform. The solutions of morphine possess an alkaline reaction. It dissolves without decomposition in solution of potassium. On account of its insolubility in water, it is employed for medicinal purposes preferably in the form of its soluble salts.

Codeine is present in opium, combined with meconic acid, and is separated from morphine by means of an alkaline solution. This is a colorless, crystalline substance; anhydrous or hydrated, depending upon whether it crystallizes from an ethereal or aqueous solution. Its solutions are bitter to the taste and of an alkaline reaction. Codeine dissolves in water, alcohol, ether, and chloroform. It is the methyl derivative of morphine and, as found in the shops, is of uncertain composition and may be contaminated with morphine.

Apocodeine is a derivative of codeine, obtained by heating codeine hydrochlorate with a concentrated solution of zinc chloride.

A new alkaloid has been discovered, named xanthaline on account of the yellow color of its salts. Xanthaline is so feeble a base that when one of its salts is placed in water the acid separates, leaving the alkaloid, which is nearly white in color. By the action of nascent hydrogen on xanthaline, another base, hydroxanthaline is formed, the sulphate of which occurs as hard, white crystals.

It is probable that these principles exist in a highly complex arrangement in opium, and that separately none of them completely represents the drug; possibly some of them are derivatives of the others, and not proximate compounds.

Some of the chemical reactions and tests of opium are interesting. Solutions containing meconic acid turn red in contact with the tincture of ferric chloride, and the same reagent turns morphine blue, afterward changing to green; nitric acid turns morphine to blood-red, changing to yellow. According to Wormley, the nitric-acid test is capable of detecting $^{1}/_{10000}$ grain of morphine, in the dry state.

A new test for morphine has been described by M. Laneal. A few drops of a suspected fluid being placed in a porcelain capsule, there is added an equal quantity of a solution of 30 parts of uranium acetate and 20 parts of sodium acetate in 1000 of distilled water. The mixture is evaporated over a water-bath and, if morphine be present, a brownish-red or orange deposit is left in the form of concentric rings.

Opium preparations, in solution, afford precipitates with solutions of many of the metals in the form of an insoluble meconate. The alkaloids are precipitated by the addition of an alkali, or tannic acid. It should also be stated that there is present a small proportion of glucose in gum opium, which chemically makes it incompatible with silver nitrate, and pills containing these in combination may explode. The formerly much used lead-water-and-laudanum mixture is dependent for some of its effect upon the

extemporaneously formed meconate of lead, which is yellow in color and unsightly and dirty; dilute lead-water with alcohol is colorless, and will probably answer the purpose as well.

Hager has shown that opium and morphine in solution, when exposed to a temperature between 203° and 212° F., lose a considerable portion of their narcotic power. To these preparations he gives the name of mitigated opium. After subjection to this process the residue may be reduced to powder, from which preparations corresponding to ordinary opium may be made. The mitigated preparations may be useful in cases of children, women, and debilitated individuals.

Physiological Action.—Opium is a stimulant, narcotic, anodyne, antispasmodic, and intoxicant. Its taste is bitter and somewhat acrid; it gives rise to a sensation of dryness in the mouth and throat, and subsequently to a viscid secretion, with huskiness of the voice. It restrains the movements and checks the secretions of the stomach and intestinal canal. As a result of his experiments, Nothnagel concluded that opium in moderate doses stimulates the inhibitory nerves of the intestine, but paralyzes them when given in excessive doses. This accords with the observed fact that under the influence of this drug constipation is not infrequently followed by exaggerated peristalsis and free evacuation of the bowels. The pancreatic and hepatic secretions are lessened, and the stools sometimes become clay-colored under the influence of opium.

The action of opium and morphine upon the bowel has been studied anew by Spitzer, whose experiments were conducted upon frogs, rabbits, and men. The sensitiveness of the bowel to painful impressions was diminished by small doses of the watery extract given subcutaneously, the effect being due to a local influence upon the nerve-centres in the wall of the bowel. Large doses are required to diminish peristalsis. Morphine has the same influence as opium, but the other alkaloids have little action upon the intestine. In healthy men, opium, given subcutaneously, has somewhat less action upon the bowel than when given by the mouth. Leubuscher has made a comparative study of the influence of the opium alkaloids upon the movements of the bowel. He concludes that morphine is the most efficient agent in allaying intestinal movements. Papaverine comes next to morphine in this respect. Narcotine is much feebler. Narceine and codeine are altogether inefficient. From 0.01 to 0.02 Gm. (or gr. $^1/_6$-$^1/_3$) of thebaine excited violent intestinal contractions.

The drug is not perfectly represented by morphine, and many persons who are able to take some of the opium preparations with good results are made sick by morphine. Owing to the preponderance of morphine over the other principles in opium, it will lead to no confusion if we consider them together. In order to produce its characteristic effects, opium, or its active principles, must be absorbed into the blood and carried to the motor, sensory, and higher nervous centres, and to the terminal end-organs of nerves. Having been carried to the brain and cord, the functions of the ganglion-cells are at first stimulated, and secondarily depressed or inhibited, probably owing to the salts' diffusing through the cell-wall and entering temporarily into combination with the protoplasm. Subsequently they are removed by fresh supplies of blood and carried to the excretory channels, particularly the alimentary canal and kidneys. E. Tauber found that when morphine was administered hypodermically to dogs, for several days, he was able to recover

41.3 per cent. of the drug from the fæces.[1] Morphine has a different effect upon dogs and cats. In the former it exerts a narcotic influence, but M. Guinard has observed that it acts as an excitant upon cats. This effect is in proportion to the dose employed. When lethal amounts were given, death was preceded by convulsions.

Alt has shown that after injection, subcutaneously, morphine can be detected in the stomach. Further investigation by Hitzig has shown that, consecutive to this excretion of morphine by the stomach, the quantity of the gastric juice is decreased and its acidity is lessened. When the action of the drug is at an end an excess of hydrochloric acid is secreted. In one case the same effect upon the acidity of the gastric juice was demonstrated in the human being. Rosenthal points out that the salivary glands also separate morphine from the blood. In the case of patients who were taking no more than 0.05 Gm. (or gr. $^5/_6$) daily the characteristic reaction of morphine could be obtained. A cumulative action was likewise observed. In patients taking only 0.01 Gm. (or gr. $^1/_6$) daily the reaction failed to make its appearance until after the lapse of three or four days. As the saliva is so much more easily obtained than the contents of the stomach, this observation may prove of medico-legal interest. Rosenthal has shown, moreover, that the elimination of morphine is independently performed by the salivary glands and by the stomach. After making its appearance in the saliva the reaction could be obtained for several days, and it is probable that a considerable proportion is excreted by this route. Morphine does not appear to be destroyed, or materially altered, in passing through the animal organism. It seems probable, however, that small amounts of the alkaloid are decomposed within the body, while larger quantities escape without change. Morphine is likewise eliminated by the skin and kidneys. Elimination seems to proceed slowly, as morphine has been found in the urine several days after the drug had been discontinued.

The paper of Drs. R. Stockman and D. B. Dott on "The Pharmacology of Morphine and Its Derivatives,"[2] and that of Dr. Stockman "On the Pharmacology of Some Bodies Derived from Morphine,"[3] contain the results of a laborious series of investigations in a very interesting field, and form a valuable contribution to our knowledge of the influence of chemical change on physiological action, as well as to the pharmacology of morphine. Their conclusions only can be stated here; for details the reader is referred to the original sources. Morphine primarily affects the nervous system; in small doses it depresses the action of the spinal cord; in larger doses it stimulates it, even to the production of convulsions. The late appearance usually of increased reflexes is accounted for on the ground that at first only a small quantity of morphine reaches the cord. It has been held by some observers that morphine is capable of directly paralyzing the motor endings of nerves. Stockman and Dott record experiments tending to show that morphine does paralyze more or less completely the nerve-endings, but only when large amounts come in contact with them. In the case of the sensory nerves the action is much the same. In man, tetanic symptoms are very exceptional,

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[1] "Ueber das Schicksal des Morphins im thierischen Organismus," *Archiv für Experimentelle Pathologie und Pharmakologie*, July 24, 1890.

[2] *British Medical Journal*, July 26, 1890.

[3] "Transactions of the Ninth International Medical Congress," Washington, 1887, volume iii, p. 47.

for, after therapeutic doses, the amount of morphine reaching the peripheral nerves is not usually sufficient to affect them. In infants and young children, however, convulsions not uncommonly occur as a result of poisoning by opium. Viewing morphine ($C_{17}H_{19}NO_3$) as a compound containing two hydroxyl groups, the hydrogen of one or both of these groups may be substituted by more or less complex radicles, forming derived bodies, which, being tested, produce positive physiological results, more or less approaching those of morphine. From these researches they conclude that chemical changes, restricted to what may be called the outlying groups of the molecules, cause very little change in the physiological action, but where a change is made in the kernel or ground-work of the molecule the action is much more profoundly altered. In codeine, or methyl-morphine, they found that the narcotic action was much diminished by the substitution of the alkyl radicle for the hydrogen atom, while the tetanic action and the action on the motor nerves were increased. The paralyzing effect on the motor nerve-endings was also more decided. Codeine is anodyne and hypnotic, and causes less general disturbance than accompanies the action of morphine. The generative functions are depressed by opium, and in chronic poisoning the menses cease and men become impotent while under its influence. Passower has demonstrated that the abuse of morphine may occasion atrophy of the female generative organs. In a patient observed during two years it was inferred, from the early failure of menstruation, that the atrophic process began in the ovary. During the period named the uterus diminished in size by $1\,{}^{2}/_{10}$ inches and atrophy of the vulva was evident. The secretion of urine is lessened, but the bladder is often rendered irritable and urine is passed frequently in small quantities. On the other hand, partial paralysis, with retention, may occur. Althoff has proved experimentally that degeneration of the posterior columns of the cord in the dorsal region was produced in dogs who had for a long period received hypodermic injections of morphine. This observation is in consonance with the clinical fact that morphine habituates, in some instances, manifest ataxic symptoms. This drug increases the amount of urea and phosphoric acid eliminated.

The hypnotic action of opium is due partly to the lessened activity of the cerebral cells and partly to a reduction of the blood-supply to the brain-centres. It is therefore a cerebral depressant. Small doses, however (0.065 Gm., or gr. j, or less), temporarily lessen all the secretions except that of the skin, and stimulate the circulation; the heart's action is increased, arterial tension raised, and the pupils contract and do not respond well to light. Slightly quickened at first, the action of the heart soon becomes more slow and forcible. Immoderate doses may cause rapid and feeble action. These effects are attributable to exaltation or depression of the function of the pneumogastric nerve.

With this, in some persons, there is exhilaration and increased cerebration, with a sense of calm and indisposition to sleep until the effect passes away, when sleep occurs, from which the subject wakens with a headache, disordered stomach, and constipated bowels. In others, cerebral activity does not occur, but the spinal functions are exalted and restlessness occurs, with some irritation of the skin, or even an erythematous eruption. At times a general rash, resembling that of scarlet fever, is witnessed, and this eruption may be succeeded by desquamation. In a case reported by Dr. A. J. Lanz the eruption was of this character, and its development was preceded

by severe rigor, fever, and headache. In other cases an urticarial efflorescence may appear. Itching of the nose and of the skin is a very common result of a dose of opium. In some persons the soporific effect is followed by severe physical depression, accompanying sickness of the stomach. In others, small doses of opium or its alkaloids occasion syncope and alarming dyspnœa. This substance exerts little or no local action. Its active principles, however, are quite readily absorbed through the unbroken skin.

Morphine, hypodermically injected, is less apt to affect the appetite and bowels than opium given by the mouth. If, however, the solution should be thrown directly into a vein, temporary dyspnœa and clonic spasm may be produced. Larger doses arrest digestion and may cause vomiting, with diaphoresis. The heart and circulation become depressed, the bodily temperature reduced. A stuporous sleep is produced, with irregular and slow respiration, cool, clammy skin, and pin-point contracted pupils. In other cases coma-vigil and delirium may occur. Infants are extremely susceptible to the influence of opium. The drug should be administered to them in very small doses, if at all, and its effects carefully watched. Aged people, also, bear it less well than those in the prime of life. Women are more amenable to the drug than men, and usually require smaller doses.

If a fatal dose has been taken, the above symptoms intensify, the pulse becomes slower, respiration is reduced to five or six to the minute, the reflexes become abolished, and death occurs from paralysis of the respiratory centre or carbonic-acid accumulation in the blood. Post-mortem examination may show some of the drug yet remaining in the stomach or intestines, and the internal organs reveal considerable venous congestion, especially the lungs. Laudanum is the agent most frequently taken with suicidal intent, and its presence may often be detected simply by the odor of the contents of the stomach. Death has resulted from 15 c.cm. (or f℥ss) of laudanum given in an enema to a patient suffering with enteric fever.[1]

As instances of its aberrant effects, Prof. Edward T. Reichert points out that morphine will sometimes cause wakefulness in doses which ordinarily produce sleep and that instances are on record which show that in some people the administration will give rise to pain. In experiments upon dogs he has also occasionally found this alkaloid to act as a respiratory stimulant. This idiosyncrasy must not be lost sight of. In many persons morphine, in usual doses, causes excitement and restlessness. These idiosyncrasies represent the persistence of the primary effects of the drug. The pain results from a stimulant or excitant effect upon the sensory cells of the nerve-centres. When constipation is caused by spasmodic contraction of muscles, opium will relieve this condition and produce bowel-movements.

The action of codeine resembles that of morphine, but is less decided. It is not so apt to derange the stomach or produce constipation. Codeine is not so potent an anodyne or hypnotic as morphine. Excessive doses have caused alarming prostration and distressing pruritus. In a case described by Dr. Spratling the symptoms produced by taking 0.50 Gm. (or gr. viij) of codeine were nausea, vomiting, restlessness, convulsions, slow respiration, intense thirst, feeling of fullness in the head, and extreme irritation of the skin. The patient did not sleep or lose consciousness, but the pupils were fixed and contracted to a pin-point. It is stated that the codeine of the

[1] *British Medical Journal*, Nov. 26, 1898.

shops often contains an appreciable quantity of morphine, and this fact should be borne in mind when large doses of codeine are prescribed.

Intoxication from codeine is treated upon the same principles as that produced by the ingestion of morphine or opium. A tolerance of opium may be ultimately established, and, in those to whom it is constantly given, the dose must, from time to time, be increased in order to produce the desired results.

Protopine, according to the experiments of Engel,[1] produces in mammals an action similar to camphor, death following its use by a paralysis of the respiratory centre. Fubini and Benedicenti have investigated the properties of **laudanine**, a crystallizable substance which forms salts with the acids. It appears to act principally upon the spinal cord, causing at first tetanus and afterward paralysis.

Diagnosis of Opium Poisoning.—Opium poisoning may be mistaken for cerebral apoplexy or alcoholic intoxication, but attention to a few points of diagnosis will prevent error. The history may, or may not, assist in deciding the question. In **apoplexy** there is no contraction of the pupils (except in one case, which will be mentioned presently), the eyes are deviated to one side, the sides of the face may not be symmetrical, and there is also paralysis of one or both limbs. The symptoms come on suddenly, often on rising in the morning; there is generally no history of taking any poison or food immediately before the attack; the face is congested or pale, not swollen and cyanosed as in opium poisoning. In hæmorrhage into the pons Varolii, there is contraction of the pupils, but, as such cases are rare and generally fatal, the mistake will not be often made; moreover, the attack is sudden and the entire body is relaxed with involuntary evacuations of the contents of the bowels or bladder, which does not occur in opium poisoning. In **alcoholic intoxication** the patient can usually be roused to answer questions; the pupils may be contracted, but will dilate when the patient is disturbed, or his beard is pulled; the odor of alcohol may assist in the diagnosis. It is possible, however, for the patient to swallow laudanum at the close of a dinking bout, and thus have both forms of intoxication. **Uræmic coma** might possibly be mistaken for opium poisoning, but in this the pupils are not contracted, œdema is generally present, and the urine contains albumin and casts; in alcoholism it will contain alcohol.

Treatment of Poisoning.—The stomach should be promptly evacuated with quick-acting emetics, such as zinc sulphate or ipecacuanha, or by repeatedly using the stomach-pump. Emetics must be given in large doses because of the stomach's insensitive condition. A tablespoonful of mustard or alum in a pint or more of hot water acts as an efficient emetic, or apomorphine may be given hypodermically. Tannic acid may be given as a chemical antidote. After the stomach has been washed out, a pint or two of warm (not boiling-hot) coffee should be injected into the stomach and rectum. Artificial respiration should be practiced both by Sylvester's method and by the application of the faradic current, one pole to the cervical region and one over the ensiform cartilage. No attempt should be made to directly faradize the phrenic nerve, on account of the danger of paralyzing the heart. The circulation should be maintained by massage, rubbing the blood up toward the body from the extremities, and, if the blood is heavily carbonized, vene-

[1] *Gazette Médicale de Paris*, Oct. 11, 1890.

section may be performed with advantage. The surface of the body may be stimulated by the faradic brush, or by whipping with the fringed ends of towels or with twigs. The patient should be made to walk about supported by two assistants, as soon as he is restored to consciousness, and kept walking at intervals for six or eight hours, or until the influence of the opium has entirely passed off. Nevertheless, this exercise should not be too long continued on account of its exhausting effect upon the muscular system and heart. The capital point in the treatment is maintenance of respiration. If the measures instituted are found to gradually increase the number of respirations per minute, the coma, in itself considered, need not be feared. The catheter should be used from time to time in order to encourage excretion by the kidneys. The patient should not be exposed too much to cold, on account of his lowered temperature and the danger of causing a subsequent attack of pulmonary congestion. The physiological antagonists—atropine, caffeine, or strychnine[1]—may be used cautiously, but only in physiological doses. Atropine may be injected hypodermically, in doses of 0.0005 to 0.0006 Gm. (or gr. $^1/_{120}$-$^1/_{100}$), if the respirations become very slow, but the state of the pupil is no guide to the effect of the antidote. Strychnine can be administered subcutaneously in from 0.0006 to 0.003 Gm. (or gr. $^1/_{100}$-$^1/_{20}$) every hour or two until an improvement in the respiration takes place. Ammonia inhalations are useful, and when properly used are harmless. Opium poisoning produces no characteristic lesion. By reason of idiosyncrasy alarming results have followed the administration of small medicinal doses.

Permanganate of potassium was first recommended, in 1877, by Barker Smith, as an antidote to morphine, experiments having shown that, when taken after a large dose of either morphine or opium, it may entirely neutralize the effect of those drugs. It is also an efficient antidote to other vegetable poisons.[2]

Dr. William Moor, of New York, advocated potassium permanganate, administered in conjunction with dilute sulphuric acid, as a chemical antidote to opium. If given while the poison still remains in the stomach the permanganate neutralizes the morphine. A quantity of the antidote at least equal to the amount of morphine swallowed should be administered, well diluted with water. Cases have been reported in which this mode of treatment proved effectual even after absorption had occurred. Other methods may be used in conjunction with this treatment. Hayes reports a case of opium poisoning believed to be saved by hypodermic injection of 0.20 Gm. (or gr. iij) of potassium permanganate, every hour, until 0.75 Gm. (or gr. xij) had been given.[3] It is very doubtful, however, if any antidotal effect can be obtained by hypodermic injections of potassium permanganate, although several cases are on record in which recovery was attributed to this cause. Where the poison is still in the stomach, however, it may be destroyed by washing out the organ with weak solutions of permanganate.

In desperate cases recourse should always be had to artifical respiration.

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[1] See papers, "Strychnine in Poisoning from Narcotics," by Dr. G. A. Gibson, in *Practice*, Dec., 1888; "Some of the Uses of Nux Vomica and Strychnine," by Dr. Frank R. Fry, in *Weekly Medical Review*, Feb. 23, 1889; "Strychnine in Opium Poisoning," by Dr. Clara T. Dercum, in *University Medical Magazine*, Jan., 1891.

[2] *London Lancet*, Oct. 31, 1896.

[3] *New York Medical Record*, May 25, 1895.

Dr. George E. Fell practices what he terms "forced respiration": a method which consists in opening the trachea and forcing air into the lungs by means of a mechanical appliance. He has used this method successfully in eleven cases, of which five would, in all probability, have proved fatal under any other treatment. As a result of this procedure he has seen recovery after 1.30 Gm. (or gr. xx) of morphine had been taken.

The action of opium on the heart, even when it has been administered in large doses, is insignificant. There is, indeed, usually stimulation rather than depression. In a case of profound opium poisoning reported by John Slade Ely,[1] for more than six hours after cessation of spontaneous respiration, and during continuance of artificial breathing, the heart continued to beat with good strength. It may be considered as clearly established by this and other cases, that in acute opium poisoning, death is the result, primarily, of paralysis of respiration. In a considerable number of cases of profound opium poisoning in which artificial respiration was the only treatment recovery has resulted.

Inasmuch as the morphine excretion occurs principally through the gastric mucosa, lavage of the stomach is a useful method of treatment. As it has been shown that potassium permanganate possesses a peculiar selective action upon morphine, converting it by oxidation into harmless oxydimorphine, the gastric lavage is made more efficient by the addition of a small proportion of potassium permanganate to the water. As also recommended by Dr. Ely, the conservation of the patient's strength is of importance. Artificial respiration is better than flagellations or other methods ordinarily used to keep the patient awake.

As a rule, no after-results follow recovery from opium poisoning except pulmonary congestion, or the effects of the rough manipulations that the patient may have been subjected to in the efforts made to keep him awake. However, a case of amaurosis has been reported, and glycosuria also is said to have occurred in consequence of the intoxication. The smallest dose recorded as having proved fatal to an adult is 0.01 Gm. (or gr. $^1/_6$) of morphine.

When mothers are suckling their babes, any of the preparations of opium should be given sparingly, if at all, because, being partly eliminated by the milk, it may narcotize the infant. As previously stated, infants are easily affected; and when children have coma or convulsions, *and the pupils are contracted*, the attendant may suspect that some one has administered an overdose of opiate to them.

Treatment of Opium Addiction, or Morphinomania.—The treatment of chronic morphine poisoning, or opium-eating, is often more moral than medical. In such cases the will of the unfortunate victim is so weakened by self-indulgence that the acquired taste for the drug cannot ordinarily be resisted, and he will acquire means for its gratification at any cost, or, if it is not obtainable, he may destroy himself. The medical attendant, before undertaking the treatment, must thoroughly gain the confidence of the patient; he should try to establish an understanding, and, if possible, sympathy, with him. He should make sure that the patient really wishes to escape from the terrible thraldom of the drug, and will co-operate with his physician. The patient should be put upon his honor, and pledge himself to obey orders and confine himself to the quantity permitted by his physician and to med-

[1] *Yale Medical Journal*, October, 1903.

icines passing through his hands. The daily amount must first be accurately determined, and an effort made at once to reduce this one-half, afterward diminishing day by day, supplementing the treatment by ammonium valerianate, fluid extract of coca, or camellia, with tonics, easily-digested food frequently given, and some alcohol, in the form of an elixir preferably. It is advantageous to change the form of the drug: if the patient has been taking laudanum or other opiate, give morphine instead; if he has been taking morphine sulphate, change it to the valerianate or some other salt. A change of scene is often beneficial. Massage is a useful adjunct to the treatment.

Patients frequently take more of the drug than is necessary to satisfy their cravings; the first thing, therefore, to be done is to ascertain the minimal amount which is required. The organs by which the drug is excreted should be put in as perfect working order as possible, giving tea, coffee, and moderate doses of sparteine to stimulate the functions of the kidney, and using hydrotherapeutic measures to increase the activity of the skin. Hyoscine hydrobromide is a valuable sedative for the nervous unrest, but should be given cautiously (ordinary dose, hypodermically, 0.0003 Gm. (or gr. $^1/_{200}$), given once a day). Warm baths and pilocarpine hydrochloride will maintain the function of the skin. This gradual method of suppressing the drug should only be employed in patients who show a marked morphine cachexia. The abrupt method may be used when a medical man is at hand to administer a dose of the agent in case of serious collapse, and is suitable for cases that are not of long standing, or in which the patient is young and free from cardiac or other visceral lesions. In most cases an intermediate method, that of Erlenmeyer, is advisable—a rapid method, but not abrupt, combining the safety of the gradual method with the quickness of the other. The patient must first be put into a condition to sustain the process of demorphinization, and then each day a half of the daily dose may be cut off; when the dose has become very small the drug may be altogether discontinued. For severe cases, eight to ten days are usually sufficient; for slight cases, six to eight days. The advantage of this plan is that, while allowing a sufficiently safe withdrawal of the morphine, affording a protection against collapse and sudden death, yet a long time is given for convalescence. In whatever way the deprivation is brought about, the patient may be greatly relieved by counteracting the excessive acidity of the gastric contents. This follows on the withdrawal of the morphine, which, being in great part excreted by the gastric mucous membrane, has inhibited the secretion of the gastric juice. This hyperacidity is not improbably the cause of the vomiting, diarrhœa, insomnia, lumbar pains, etc. The desired object may be obtained by causing the patient to drink Vichy or other alkaline water. If the pulse should become irregular and very weak, morphine must be injected. But good feeding, with coffee and milk, should be sufficient in most cases to prevent collapse. Care must be taken in employing other hypnotics, such as chloral, bromides, sulphonal, and in using alcohol or heroine, lest another habit should be substituted for the morphinomania. To lower blood-tension and favor elimination, artificial serum may be injected subcutaneously. Prognosis should be reserved, and prophylaxis is always more hopeful than cure.

Dr. Paul Sollier[1] gives some very instructive views on his method of treating patients who have for many years been addicted to the use of morphine. When regularly injected in a continued manner, morphine causes, after a considerable time, a more or less important diminution of the activity of the nervous system, and a very marked slowing of the processes of glandular secretion. When morphine is rapidly withdrawn, there is commonly a resumption of the glandular functions; but this does not happen immediately in all the organs at the same time, the different phenomena appearing one after the other. Most frequently perspiration and sneezing open the scene, accompanied with yawning. Then diarrhœa appears—at first ordinary fæces, then pure bile, afterward loose motions, half-bilious, half-fæcal in character; mucous vomiting (gastric juice), then bile, where there is any, appears after the diarrhœa has started and stops before it. Spermatorrhœa appears next, then salivation and muscular cramps. Each glandular apparatus begins operations in its turn, without any determined order in this succession of phenomena, which varies with each person and depends on the different degrees to which the different organs of the body are impregnated with morphine. The mechanism by which the system rids itself of morphine appears to be an epithelial and endothelial desquamation of the impregnated mucous membranes. These processes may be renewed during six or eight weeks after abrupt withdrawal of the drug, and, when complete, correspond to a *restitutio ad integrum* of the affected organs. Assuming that these premises are correct, it follows that the stronger the reaction of the organism, the more abundant will be the desquamation at first, and the more rapidly will organic regeneration be brought about. Hence the object in treating a patient with the morphine habit is to favor as much as possible the elimination of the altered glandular elements, to provoke the appearance of each secretion, if slow in appearing, or if it slackens its work when begun or stops too soon. To meet these indications it suffices to excite glandular activity by every known method, while at the same time lessening the quantity of morphine. Purgatives, diuretics, and diaphoretics ought to be used concurrently. Under the influence of these medicines, and the rapid diminution of the quantity of morphine, the resumption of glandular activity begins before complete removal of the drug is enforced. The effort of the organism at this time is therefore less intense, the emunctories being already prepared. Hence it results that the heart is not forced to perform excessive work, and the pain provoked by the reaction of the organism, striving to free itself of its altered elements, is reduced as much as possible. Dr. Sollier, since using this method, has not observed, even in patients with diseased hearts, any signs of heart-failure or syncope, and still less has he been confronted with the collapse which frightens so many morphine-takers when trying to get cured, and physicians who have not had any experience in such cases. When the morphine-taker is thus prepared for weaning, not only is there no serious accident to dread, but it is useless to give him any heart-tonic, such as sparteine or caffeine, for heart-failure need not be apprehended. When, on the other hand, weaning from morphine is begun without having taken previous precautions to prepare for glandular elimination, one is exposed to what may be called a false elimination of morphine. Sollier explains this as follows: Weaning from morphine should not be confounded

[1] *La Presse Médicale*; *Canadian Journal of Medicine and Surgery*, Oct., 1898.

with elimination of the drug from the system. Weaning may be put in force, but elimination may not follow. Should this occur, convalescence does not take place, or else comes on in a slow, torpid manner, and besides even fatal results may happen. He is opposed to the use of other hypnotics when treating a morphine-taker. Adjuvants, such as sparteine and caffeine, are sometimes used if the heart is weak. Antipyrin and bromide of potassium are used when there is a tendency to cerebral congestion. He is totally opposed to the use of sulphonal, bromidia, chloral, etc., and thinks that sulphonal is very dangerous. By many observers the hydrobromide of hyoscine has been found to be a very valuable adjunct to the treatment of these cases. It is a powerful sedative and hypnotic; but it should be given in small doses (0.0003 Gm. or gr. $^1/_{200}$), once or twice daily, and its effects should be carefully observed, as it is liable to cause hallucinations. With this is combined strychnine sulphate, every two or four hours, and purgatives, such as calomel, podophyllum, and ipecac. This is advocated by H. A. Hare,[1] Bering,[2] of Tulare, Rosenberg, and a number of others.

There is a fundamental fact to be borne in mind in the treatment of this class of patients, as pointed out by Kellogg; it is that the majority of persons who acquire the vice of drug addiction are peculiarly constituted, and are either those who live entirely upon the sense-plane, whose highest aim is to gratify their appetites, and who, when the natural resources begin to fail, stimulate them with various drugs; or they belong to a class of neurotic, hypersensitive individuals, who are the products of the brain-destroying and race-deteriorating conditions of modern life. In such cases the drug treatment should be secondary to hygienic measures, particularly diet, massage, electricity, and hot or cold applications to the occiput and spine. Relapses in such individuals should not discourage the physician or the patient.

Therapy.—Powdered opium may be mixed into a paste with water and applied to an incipient boil with relief. Laudanum with water is a useful application to sprains and bruises; and it may be added to poultices to form an anodyne fomentation or applied to wounds as an antiseptic and to relieve pain. Laudanum and sweet-oil should not be used for earache, because in case of perforation a child might be narcotized in this way, by the drug passing down the Eustachian tube into the throat. Many anodyne liniments contain opium, and when these are applied with friction the remedy is partly absorbed. Such applications assuage the pain of chronic or muscular rheumatism, and even, at times, of sciatica. A warm lotion containing opium affords relief in synovitis and orchitis. Laudanum is usually a serviceable topical remedy in painful ulcers.

Opium may be combined and used thus locally:—

℞ Tinct. opii	30	c.cm. or f℥j.
Chloroformi,		
Tinct. aconiti	aa 15	c.cm. or f℥ss.
Ol. menth. pip.	4	c.cm. or f℥j.
Lin. saponis	60	c.cm. or f℥ij.

M. Sig.: Apply with friction over the surface for neuralgia or rheumatism.

℞ Tinct. opii,		
Aquæ hamamelidis,		
Aquæ camphoræ	aa 60	c.cm. or f℥ij.

M. For an application to acute gout or rheumatism.

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[1] *Therapeutic Gazette*, June, 1902.

[2] *Cal. State Journal of Med.*, July, 1905.

℞ Tinct. opii,
Alcoholis diluti,
Aqua hamamelidis ..... aa 60| c.cm. or f℥ij.
M. Serviceable in synovitis, felons, or orchitis.

℞ Tinct. opii,
Fluidext. arnicæ,
Lin. saponis ..... aa 30| c.cm. or f℥j.
M. For enlarged glands and thickened states of the skin.

℞ Extracti opii,
Extracti arnicæ,
Extracti belladonnæ folior ..... aa 4| Gm. or 3j.
Ungt. hydrargyri oleatis (10 per cent.) ..... 31| Gm. or ℥j.
M. For arthritis.

℞ Extracti opii ..... 2| Gm. or 3ss.
Cocainæ hydrochloridi ..... |65 Gm. or gr. x.
Mentholi ..... 1| Gm. or gr. xv.
Ungt. zinci oxidi ..... 31| Gm. or ℥j.
M. Beneficial in anal fissure, rectal eczema, and in hæmorrhoids.

The inhalation of steam impregnated with paregoric, or the watery extract of opium, is beneficial in acute pharyngitis and laryngitis. Ringer advises the application of morphine, dissolved in honey or glycerin, to relieve the throat-cough of phthisis. This solution, or an opiated lozenge, is not without efficiency, even when the cough is entirely dependent upon the pulmonary condition. Gargles containing opium are often of benefit in the diseases named:—

℞ Tinct. opii camphoratæ,
Tinct. benzoini comp.,
Tinct. kino ..... aa 30| c.cm. or f℥j.
M. Sig.: Employ, diluted with water, as a gargle.

℞ Tinct. opii camphoratæ,
Aquæ menth. pip.,
Glycerini ..... aa 30| c.cm. or f℥j.
M. Sig.: Use as a gargle, diluted with water.

The oleate of morphine, with lanolin and a little chloroform, is a sedative application, or we may dissolve morphine in chloral-camphor and apply it over the site of pain. In various inflammatory conditions of the skin or conjunctivæ, fomentations with the recent decoction of poppy-heads is a soothing treatment, but is less anodyne and astringent than laudanum and hot water. Opium, morphine, and codeine may also be introduced into the rectum in the form of suppositories, in painful conditions of the bowel and neighboring organs, and also, for their general effects, in producing sleep and quieting cough or restlessness. A warm bath and an opium suppository are of material value in relaxing the spasm which often accompanies organic stricture of the urethra. These measures will frequently permit the escape of enough urine to cause considerable temporary relief in retention and, at the same time, facilitate the passage of a filiform bougie and catheter. An opium suppository averts the chill which may follow instrumentation of the male urethra, quiets the nervous system after operations upon the female pelvis, and relieves the pain and tenesmus of cystitis and strangury.

Dr. von Klein, of Dayton, advocates the administration, in certain cases, of morphine by the nostrils. In hay fever, a combination of morphine with cocaine in powdered gum acacia and sugar is of great value in relieving the pain and irritation.

In painful affections of the upper air-tract the following has been recommended:—

℞ Acidi tannici ..... 5| Gm. or 3i gr. xv.
Morphinæ sulphatis ..... |23 Gm. or gr. iiiss.
Pulveris acaciæ,
Pulveris sacchari ..... aa 3| Gm. or gr. xlv.
M. To be thoroughly triturated (0.40 Gm. = 0.01 morphine).
Sig.: For insufflation, a pinch at a time.

Hypodermic Administration.—Morphine is frequently injected hypodermically in order to produce its physiological and therapeutical effects, and the rule is to begin with a dose, at the most, only half as large as would be given by the mouth. Atropine is frequently combined with the morphine (0.0003 Gm. and 0.01 Gm., or gr. $^1/_{200}$ and gr. $^1/_6$), and administered in this way to enhance its effect in treating neuralgia; they are also used in this combination previous to the use of chloroform, especially when a prolonged operation is anticipated. In cases of local pain, as first pointed out by Dr. Alexander Wood, of Edinburgh, who introduced the hypodermic method, there is an advantage in making the injection close to the spot affected, although, for a general anodyne or hypnotic effect, the skin on the arm or dorsum of forearm is generally selected. The rules for hypodermic medication may be briefly stated as follows:—

1. The instrument must be surgically clean and aseptic.

2. The solution used should be made with recently-boiled distilled water, or at least with recently-boiled water.

3. The patient should not be allowed to prescribe the injection, but it should be used only when, in the judgment of the physician, it is appropriate, necessary, and justifiable.

4. The spot selected should be cleansed, and the needle pushed through a fold of the skin pinched up with the fingers of the other hand to that holding the instrument, being careful, in introducing it, to avoid proximity of veins. The desired amount being gradually injected into the loose cellular or muscular tissue, the needle is withdrawn, while with the finger pressure is made over the slight puncture and the fluid is gently dispersed under the skin.

It should be remembered that the morphine enters the circulation more quickly than when absorbed from the alimentary canal, and once injected cannot be withdrawn. In a strange patient, where idiosyncrasies are unknown, it would be wise to give not more than 0.006 to 0.008 Gm. (or gr. $^1/_{10}$-$^1/_8$) and watch the effects, repeating and increasing the dose if required. On account of the extreme susceptibility of young children to opium, the hypodermic method is considered inadvisable for them; and in elderly persons, or in patients suffering with Bright's disease of the kidneys, it is used only with extreme caution.

Special Applications.—Opium is used symptomatically to relieve pain and irritation, to relax spasm, to produce sleep, to check secretions, and to influence nutrition. The preparations of opium and its salts are so efficient and convenient in the treatment of all forms of pain that the habit of in-

dulgence is readily formed. It is therefore prudent for the physician not to inform the patient of what he is using, or to always give it in combination with other drugs. In some forms of brain disease, attended by congestion of the hemispheres, especially in the form accompanying alcoholism, opium is inadmissible. Meningitis, however, is benefited by opium, and in the cerebro-spinal form, in conjunction with ice-applications and other treatment, the deodorized tincture should be given in doses large enough to keep the patient from suffering. Professor Flechsig has formulated a method of treating epilepsy by an alternate use of opium and potassium bromide. Small doses of the extract of opium are at first given, but the quantity is gradually increased for about six weeks, when the patient is placed upon large doses of the bromide. This plan of treatment is said to be generally attended by good results and is thought to be especially applicable to juvenile patients.

In biliary, renal, or intestinal colic, morphine, given by the mouth or hypodermically, is the most common means of relief; also in angina pectoris, palpitation of the heart, or cardiac dyspnœa. It must not be forgotten that, as pointed out by M. Huchard, the most important manifestation of angina pectoris is not the pain, but the syncope with tendency to pulmonary œdema.

Small doses of opium—0.30 c.cm. (or *m*v) of the tincture, for instance—have an excellent stimulant effect in the case of a weak or dilated heart. In paroxysmal cardiac dyspnœa, as contradistinguished from asthma and that due to pleural effusion, the hypodermic injection of morphine is followed by wonderfully good results, as pointed out by Allbut and confirmed by Ringer. Respiration becomes comparatively free, lividity disappears, and sleep is rendered possible. At first 0.01 Gm. (or gr. $^1/_6$) twice or thrice a week is sufficient; subsequently it may be necessary to gradually increase the dose. This treatment more particularly applies to mitral than to aortic disease. In the cardiac accidents of rheumatism—such as myocarditis, grave forms of endocarditis, and especially in pericarditis—the opium treatment, according to Powell,[1] is of immense value, its object being to cause organic rest, so far as organic rest can be given to an automatically moving organ, by diminishing the rapidity of the pulse and quieting the restlessness and agitation of the patient. When paroxysmal dyspnœa accompanies valvular incompetency and greatly interferes with the patient's rest at night (the dyspnœa not being due to pleural or pericardial effusion), much comfort is afforded by a small hypodermic injection of morphine. Dr. Alexander McPhedran, of Toronto, pronounces opium superior to digitalis in these cases, and, in fact, indispensable.

In bronchial and pulmonary affections, irritation of the sensory end-organs often excites cough, in excess of what is demanded for the expulsion of the inflammatory products from the air-passages. Moderate doses of morphine or opium, added to an expectorant mixture, restrain the cough of irritative origin, the irritation accompanying bronchitis being relieved by opium, and cough overcome so as to permit sleep; the secretions are also checked by it, so that it is a useful remedy especially in the declining stages of bronchitis, but a dangerous one in the early or congestive stage, where even a small dose may be fatal. Small doses of Dover's powder, or of

[1] *Gaillard's Medical Journal*, May, 1900.

Tully's powder (pulv. morphinæ co.), administered by the mouth, are useful in controlling the symptoms of bronchitis, and make the patient more comfortable.

In bronchial asthma, opium alone or combined as follows, has a most decided action in giving relief and in assisting to check the morbid process:—

℞ Tinct. opii,
Tinct. lobeliæ ..... aa 4 | c.cm. or f3j.
Ammonii iodidi ..... 8 | Gm. or 3ij.
Fluidextracti grindeliæ ..... 15 | c.cm. or f℥ss.
Glycerini ..... q. s. ad 120 | c.cm. or f℥iv.
M. Sig.: A teaspoonful three or four times a day or at any time during a paroxysm.

In pneumonia, opium in very small doses is of advantage in relieving pain and excessive cough; here it is best given in the form of Dover's powder or in the following combination:—

℞ Antimonii et potassii tart. ..... | 065 Gm. or gr. j.
Pulv. ipecac et opii ..... 2 | 60 Gm. or gr. xl.
Potassii nitratis ..... 4 | Gm. or 3j.
M. Div. in chartulæ no. xx.
Sig.: Take one every two hours, in pneumonia.

In pneumonia and pleurisy, when the pain is severe, opium may also be prescribed as follows:—

℞ Pulveris opii ..... | 25 Gm. or gr. iv.
Hydrarg. chloridi mitis ..... | 065 Gm. or gr. j.
Pulveris aromatici ..... | 75 Gm. or gr. xij.
M. et ft. chartulæ no. xij.
Sig.: A powder every half-hour or hour until relieved.

℞ Pulveris ipecac. et opii,
Camphoræ monobromat. ..... aa 2 | Gm. or 3ss.
M. et ft. capsulæ no. x.
Sig.: A capsule every half-hour or hour.

In typhus and typhoid fevers, small-pox, and other acute fevers, attended by poisoned blood and great delirium and restlessness, opium in appropriate doses at night will often be of great service in maintaining the strength of the patient. The above combination of tartar emetic and opium is extremely efficacious in those cases of typhus and typhoid fever characterized by furious delirium, insomnia, and exhaustion. In various other conditions the beneficial effects of opium are apparent. For instance, in rupture of the uterus, bladder, or intestines, in peritonitis, the only chance of recovery consists in keeping the patient fully under the sedative influence of opium, using the deodorized tincture in preference to any other form. In the treatment of intestinal hæmorrhage of typhoid fever the value of small doses of opium in supporting the circulation and promoting healing of the intestinal ulcers is well established. In after-pains, in threatened abortion, in some cases of dysmenorrhœa, the judicious use of an opiate will afford immunity from suffering.

An hypodermic injection of morphine is of much service in ovaralgia, as in other forms of neuralgia. Another statement may be made here in regard to the efficacy of this mode of treatment in neuralgia generally, viz.: not only

is the attack temporarily relieved, but not infrequently the disorder is cured, or, at least, remains in abeyance for a considerable period. Cancer of the womb, or, indeed, malignant disease wherever seated, demands, almost without exception, the administration of some form of preparation of opium. Here, and, in fact, as in all essentially painful diseases, the remedy should be given with judicious boldness. Excessive pain requires full doses; smaller fail to relieve pain, increase nervous excitement, and are prejudicial rather than beneficial. In the treatment of cancer, there need be little or no fear of founding the morphine habit. Opium is useful in acute suppression of the menses when owed to moral or emotional excitement. Severe and deep burns are always marked by profound shock and excruciating pain, and in these conditions the hypodermic use of morphine is invaluable. Herpes zoster is another malady in which morphine, especially in union with atropine, is of notable service in relieving the violent, lancinating pain.

In cough-mixtures, opium or morphine is a standard ingredient, but codeine, or heroine, has advantages when the cough is violent:—

℞ Codeinæ phosphatis	20	Gm. or gr. iij.
Tinct. belladonnæ folior.	4	c.cm. or f℥j.
Syr. pruni Virginianæ q. s. ad	90	c.cm. or f℥iij.

M. Sig.: Take a teaspoonful, when cough is annoying, four or five times daily.

In phthisis, the above formula will be useful in checking the cough at night and reducing tendency to night-sweats.

Codeine may be serviceably employed in acute and chronic bronchitis, whooping-cough, inflammatory conditions of the bowel or peritoneum, and in inflammation of the urinary passages. Its hypnotic and anodyne powers are decidedly less than those of morphine. It has been used with advantage in diabetes.

Opium is very serviceable in treating diabetes mellitus, and is preferable to codeine. Opium is, perhaps, the most efficient drug which we possess in the treatment of this disorder. It diminishes hunger and thirst, the quantity of urine excreted, and the amount of sugar eliminated. The progress of the disease is checked and the condition of the patient ameliorated. Large doses are required and well-borne in diabetes mellitus. The proper plan is to begin with moderate doses, and rapidly, but watchfully, increase according to the effect of the remedy upon the glycosuria, or until symptoms of narcotism make their appearance. Opium is also of service in diabetes insipidus, though less active than in saccharine diabetes.

In treating chronic ulcer, the administration of small amounts of opium several times daily will bring about a healthy condition and encourage healing. Given in larger quantities, 0.065 to 0.13 Gm. (or gr. i-ij) every three or four hours, opium is of equal value in the treatment of phagedæna, alleviating pain and checking the tendency to spread. This drug is beneficial in ulcerative stomatitis. Where there are excessive secretions opium will reduce them, as in bronchorrhœa, diarrhœa, dysentery, etc. In the diarrhœa of typhoid fever, opium may be judiciously and usefully employed, and it is often successful in controlling tuberculous diarrhœa. In various formulæ for cholera, opium holds a prominent place. In infants suffering with summer complaint, enterocolitis, or cholera infantum, all forms of narcotics are so dangerous as to be almost prohibited. The object of treatment is evacuation and disinfection of the intestinal tube, with administration of sterilized

food; where this has been done, opium will generally not be required. In urgent cases, starch-water enemata may be given, containing a drop or two of laudanum with 0.32 Gm. (or gr. v) of chloral-hydrate, in order to afford relief from restlessness and pain.

In the diseases previously referred to, opium is often so necessary in the treatment that we may append a few prescriptions containing this very important drug:—

℞ Pulveris opii ..... | .03 Gm. or gr. ss.
Pepsini,
Bismuth. subnit. ..... aa 2| Gm. or 3ss.
Ol. cinnamomi ..... | .06 c.cm. or *mj*.
M. et ft. chartulæ no. x.
Sig.: A powder every two or three hours for diarrhœa in children.

℞ Extracti opii ..... | .50 Gm. or gr. viij.
Pulv. ipecacuanhæ ..... 1| 1.60 Gm. or gr. xxiv.
Hydrargyri chloridi mitis ..... | .06 Gm. or gr. j.
M. et ft. pil. no. xvj.
Sig.: A pill every hour or two for diarrhœa or dysentery in adults.

℞ Tinct. opii camphoratæ,
Tinct. cardamom. comp.,
Tinct. lavandulæ co. ..... aa 30| c.cm. or f℥j.
Aquæ menth. pip. ..... 90| c.cm. or f℥iij.
M. Sig.: One tablespoonful every two or three hours for cramps and diarrhœa.

℞ Tinct. opii camphoratæ ..... 15| c.cm. or f℥ss.
Syrup. rhei aromatic. ..... 7|5 c.cm. or f3ij.
Tinct. cardamom. comp. ..... 30| c.cm. or f℥j.
Aquæ anisi .....q. s. ad 150| c.cm. or f℥v.
M. Sig.: From one to two teaspoonfuls every two or three hours for diarrhœa of children.

℞ Tinct. opii,
Spiritus menth. pip.,
Spiritus camphoræ,
Tinct. capsici ..... aa 4| c.cm. or f3j.
M. Sig.: Ten to forty drops every hour or two for diarrhœa with cramps.

℞ Tinct. opii,
Spiritus chloroformi,
Tinct. capsici,
Syrup. zingiberis ..... aa 4| c.cm. or f3j.
M. Sig.: Twenty to forty drops every half-hour or hour for cramps attended with diarrhœa.

℞ Tinct. opii camphoratæ,
Mist. cretæ,
Tinct. kino ..... aa 60| c.cm. or f℥ij.
M. Sig.: From a half a teaspoonful to a tablespoonful every hour or two for diarrhœa.

Nausea and nervous vomiting are generally alleviated by the administration of opium. This remedy is useful in seasickness and the vomiting of pregnancy, in each of which it is apt to be more efficient if given subcutaneously. The same method is of value in obstinate hiccough. The pains of gastralgia, ulcer, and gastric carcinoma are amenable to the influence of opium, which is, furthermore, useful in ulcer in restraining hæmorrhage.

There is a form of dyspepsia in which opium is of signal service. This is of an irritative character, occurs in thin people of an irritable, anxious temperament, and is indicated by a dry tongue, red at the tip and edges. Lead colic is lessened by opium. In acute obstruction of the bowels, due to spasm, 0.03 Gm. (or gr. ss) of opium every four hours, for two or three days, will often relieve stercoraceous vomiting and permit normal evacuations. Even in fæcal impaction, good results have ensued from the daily injection of 0.03 to 0.065 Gm. (or gr. ss-j) of morphine in divided doses. This treatment is especially adapted to instances in which the gut has been injured by congestion or inflammation.[1] In chronic constipation, opium alone or combined with ipecacuanha often relieves the irritable bowel and assists in restoring tone and a healthy action to the mucous membrane. In gastritis, especially the acute variety produced by alcoholism, opium relieves pain and vomiting. The nervous manifestations of exophthalmic goitre sometimes receive benefit from opium.

The antispasmodic influence of this drug has been utilized in various convulsive affections. It is of undoubted service in severe cases of chorea in which twitchings abolish sleep, and it was given by Trousseau in large doses with good effect. The *petit mal* and nocturnal epilepsy are benefited by opium. Scanzoni and Loomis have amply demonstrated the safety and the value of hypodermic injections of morphine in uræmic coma. Dr. James Tyson[2] reminds us that Dr. Alfred Loomis, who first advocated the hypodermic injection of morphine for uræmic convulsions, restricted its use to acute cases of Bright's disease, and held that it is inadmissible in chronic nephritis. In fact, the greater the destruction of the secreting portion of the kidney and the more chronic the process, the greater is the danger from opium. He has seen fatal coma produced in such a case by the administration of 7.5 c.cm. (or f3ij) of paregoric. Although inefficiency of the eliminative organs ordinarily furnishes a contra-indication to the use of this remedy, yet in acute uræmic convulsions the morphine promotes the action of the skin and seems to exert a protective influence upon the nerve-centres. In tetanus, the deep injection of morphine into the affected muscles seems to be of some service. A hypodermic injection of morphine will frequently break up a spasm of asthma. Opium is of advantage in emphysema, hay fever, and the spasmodic stage of whooping-cough. Sixty-five cg. (or gr. x) of Dover's powder alone, or, preferably, combined with an equal quantity of quinine sulphate, will often abort a cold if given in its incipient stage. Morphine is a reliable stimulant in surgical shock and heat exhaustion; in both cases it should be administered with great care. In acute and chronic mania, and in melancholia, opium is capable, in selected cases, of affording decided benefit, especially in melancholia. Its administration in cases of alienation needs, however, to be directed with enlightened judgment. Dover's powder is often successful in checking the night-sweats of phthisis. The hypodermic injection of a small dose of morphine with atropine is of avail in hæmoptysis or uterine hæmorrhage. It also is effective in relieving cough and restlessness at night, in chronic pneumonia.

Apomorphinæ Hydrochloridum (U. S. P., B. P.).—Apomorphine Hydrochloride. (See page 224.)

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[1] Phillips, *op. cit.*, p. 103.

[2] "The Use of Iron and Opium in Bright's Disease," *Journal of the American Medical Association*, July 23, 1898.

Apocodeine.—Apocodeine is an amorphous, brown powder, of an alkaline reaction, and soluble in ether, alcohol, and chloroform.

The properties of apocodeine are similar to, but weaker than, those of apomorphine.

The physiological action of apocodeine has been lately studied by L. Guinard. According to this writer, apocodeine has an hypnotic effect without causing nausea and vomiting. It increases reflex action, and, in large doses, occasions convulsions and tetanic spasms. In the opinion of Guinard, apocodeine is not an emetic, and when it gives rise to nausea it is probably contaminated with apomorphine. During the soporific action of this alkaloid the bodily temperature is reduced. Apocodeine always excites hypersecretion of saliva, bile, pancreatic and intestinal juices, and increases intestinal peristalsis. The pupil is but slightly influenced during the sleep induced by apocodeine, but during the convulsive period it is widely dilated.

Dujardin-Beaumetz stated that apocodeine was found useful in hæmoptysis, croup, and whooping-cough, and recommends it in doses of 0.015 Gm. (or gr. $^1/_4$) hypodermically, and 0.04 Gm. (or gr. $^2/_3$) by the mouth. Dr. Murrell has demonstrated that apocodeine hydrochloride is beneficial in chronic bronchitis by virtue of its expectorant properties. He administered it by hypodermic injection, which, provided the solution be neutral, produces no local irritation.

Flagg states that when opium, or any of its ordinary preparations, fails to produce a good effect, a solution of morphine bimeconate often acts well. This preparation, he adds, is an anodyne of decided efficacy where ordinary preparations of opium are not desirable or are contra-indicated. The dose is from 0.30 to 1.50 c.cm. (or *m*v-xxvj), as required.

Dr. Finney speaks favorably of the action of morphine hydrobromide. It generally, though not invariably, produces quiet sleep and relieves pain without being followed by the unpleasant effects which are sometimes caused by other morphine preparations.

The other alkaloids and constituents of opium are of great interest, but rarely used in medicine.

OREXINE AND OREXINE TANNATE.—Tannate of orexine has been introduced as a substitute for the basic orexine (phenyl-dihydro-quinazoline) and the hydrochloride of orexine, over which it has the advantage of being an odorless and tasteless white powder (resembling chalk), is well borne by the digestive organs, and free from unpleasant effects. Orexine was introduced by Penzoldt in 1890, and the tannate by Steiner. It is a stomachic tonic, and in cases of deficient secretion of acid is an efficient appetite-promoter. It should not be given where there is an excess of secretion, hyperacidity, in acute inflammation of the stomach, or in gastric ulcer. Tablets ("orexoids," Merck), each containing 0.25 Gm. (or gr. iv), may be used or the powder given in capsule or simply dropped upon the tongue. From 0.50 to 0.75 Gm. (or gr. viii-xij) may be given an hour before the principal meals (dinner and supper), the dose being washed down with a large drink of water. It has been found beneficial in improving nutrition in anæmia, chlorosis, tuberculosis, neurasthenia, and debility after acute disease. Dr. Gennaro Scognamiglio[1] found by physiological tests that orexine accelerated the digestive process in the stomach by stimulating the

[1] *Wiener medicinische Blätter*, 1897.

peptogenic function, both in healthy subjects and in dyspeptics, with a corresponding increase in the power of gastric absorption and gastric movement. Steiner recommends it for children in place of ordinary bitter tonics for anorexia. Orexine tannate is a valuable anti-emetic and gastric sedative in pregnancy, according to Köbl. In hyperemesis gravidarum, Scognamiglio gave 0.32 Gm. (or gr. v) three or four times daily as a last resort, but with complete success.

ORIGANUM.—Origanum, Wild Marjoram. Origanum vulgare (Labiatæ) is a perennial herb of Europe and the United States, with pale-purple flowers. It contains **volatile oil** (1 to 2 per cent.), with tannin, resin, and some bitter principle. It enters into aromatic wine. The oil is an aromatic stimulant, carminative, and counter-irritant.

Therapy.—Rarely used internally or externally, though formerly employed as a diaphoretic, emmenagogue, and stimulant tonic, or as a fomentation for bruises and sprains. It is also known as European Mountain Mint.

ORPHOL, Betanaphthol Bismuth, contains 71.6 parts of bismuth oxide and 23 of betanaphthol in loose combination, the compound splitting up in the intestine into these two components. It is a light-brown powder, neutral, almost tasteless and odorless, non-toxic, and non-irritating. Dose to adults up to 3 Gm. (or gr. xlv) daily, or 0.6 to 1.0 Gm. (or gr. x-xv) at a dose. Useful in diarrhœa, ptomain poisoning, typhoid fever, and cholera infantum.

ORTHOFORM, or meta-amido-para-oxybenzoic-methyl ester, is a nearly colorless, odorless, and tasteless powder, slightly soluble in water and freely so in alcohol. Its chloride is more soluble, but is irritating. Orthoform appears to have no physiological action even when swallowed in 4 Gm. (or ʒj) doses. It has decided analgesic and antiseptic powers. Dr. Kallenberger found it not hygroscopic and quite harmless to the animal organism, as injections of from 4 to 6 Gm. (or ʒi-iss) given to animals did not produce any toxic symptoms, and external applications of 60 Gm. (or ʒxv) in a week had no ill effect on the human subject. Orthoform has the power of diminishing the discharge from wounds. It may be applied in the form of ointment, especially to burns. Dr. Kallenberger[1] mentions that applied after the extraction of teeth it is a good local analgesic. It is also valuable in cancer of the larynx and other painful affections of the throat. It should not be combined with formaldehyde, silver nitrate, or potassium permanganate solutions; or in powder with antipyrin or bismuth subnitrate. It may be added to phenol, calomel, iodoform, corrosive sublimate, salicylic acid, etc.

Orthoform has been used successfully by Dr. W. P. Nicolson,[2] of Atlanta, Ga., for the purpose of making an arsenical paste painless when applied as an escharotic in removing various kinds of growths. He reports the case of a man, 60 years of age, who came to him for relief from a growth on the right side of the head, about the size of a hen's egg, projecting outward. The growth was removed, and, after controlling the severe bleeding by pressure applied a short time, the raw surface was freely sprinkled with powdered orthoform. Then, with a powder made of equal parts of arsenic

[1] *Berliner klinische Wochenschrift.*
[2] *Atlanta Journal-Record,* I, p. 738.

trioxide and powdered gum acacia, orthoform was made into a paste and applied to the cut surface and the patient given a few tablets of morphine to take when the pain became severe. The next day found the tablets unused, the patient having had no pain since the paste was applied. The result was perfect, the growth being entirely destroyed.

OSMII PEROXIDUM.—Osmium Peroxide. Osmic acid is the tetroxide of osmium. It forms colorless, acicular crystals, which sublime even at ordinary temperatures, and are easily fusible to a colorless liquid, with irritating vapor resembling chlorine, and capable of setting up inflammation of the eyes or of the air-passages.

Physiological Action.—In animals, osmic acid is actively poisonous in doses of only a few grains. A 1-per-cent. solution in water, or water and glycerin, is injected subcutaneously in man in the treatment of painful tumors and superficial neuralgia. No reaction, as the rule, follows these punctures, but sanguineous cysts and boils have been reported. A painful eruption upon the skin sometimes results from the application.

Therapy.—In some cases of neuralgia, the injection of a few drops of the centesimal solution deeply into the neighborhood of the nerve affected affords prompt relief to pain. The following is the technique of the operation, as given by Bennett and carried out by Murphy.[1] The nerve is exposed through a small incision about a half-inch in length. The nerve is elevated by means of a blunt hook, and from five to ten minims of a fresh 1.5-per-cent. solution of osmic acid injected directly into its substance. An ordinary hypodermic syringe and fine needle are used, and the solution injected in several different places, to be sure that every fiber is reached. After this is accomplished a small amount of the solution is injected between the nerve and its sheath in the bony canal. During the procedure a small pledget of cotton is held around the needle to absorb the excess of solution which regurgitates and to protect the skin. The local action of the osmic acid on the terminal nerve filaments exposed in the wound is probably beneficial, so a small amount of it should be allowed to come in contact with them. After the injection is completed the incision is closed with horsehair or catgut suture; primary union follows, and healing is not interfered with by the action of the acid on the tissues. It has also been applied to the skin in treatment of chronic indurated acne and some tubercular syphilides. Administered internally in epilepsy, in doses of 0.01 Gm. (or gr. $^1/_6$) daily in pill form, it failed to have any beneficial effect in the hands of Dr. Schroeder.[2]

Dr. S. H. Auerbach reports a good result in a case of goitre from parenchymatous injection of 1.20 c.cm. (or *m*xx) of a solution of osmic acid in the strength of 0.065 Gm. (or gr. j) to 7.50 c.cm. (or f3ij) of water. The injection was practiced once a day or once in two days for three weeks. Local massage and the internal administration of potassium iodide were conjoined.

OXYCAMPHORA.—Oxycamphor. Oxycamphor is a white crystalline powder, soluble in two parts of cold, but freely in hot water and in alcohol. The solution has a peppery, bitter taste. It is usually sent out dissolved in

[1] *Journal of Am. Med. Assn.*, August 22, 1903.
[2] Inaugural Thesis, University of Kiel.

alcohol, under the name of Oxyphor, containing 50 per cent. of the drug. The dose of this solution is 2 to 8 Gm. (or ʒss-ij), (1 to 4 Gm., or gr. xv-lx, of oxycamphor). It is not a stimulant to the cerebrum, like camphor; but is a depressant to the respiratory centre. It has been found useful in asthma, dyspnœa, and whooping-cough.

OXYMEL (B. P.).—**Oxymel.** (See page 543.)

PAMBOTANO.—Pambotano-bark. Pambotano, or Calliandra Houstoni (Leguminosæ), is a Mexican shrub which grows to the height of three or five feet. Its active principle is unknown. Dose (given in four portions during the day), 77.5 Gm. (or ʒiiss) to an adult, and 31 Gm. (or ʒj) to a child.

Therapy.—Pambotano has been given in recent decoction as a hot drink; or in the form of an alcoholic elixir in malarial fevers, as a substitute for quinine, in cases uninfluenced by the latter drug. Successful results were obtained in many cases by Valude, Bandera, Betances, Pellatan, and other observers, in Mexico, Central America, and Rome. A series of eight cases was treated by Dr. A. E. Roussel, of Philadelphia, by means of pambotano, with results which were decidedly encouraging, though not so brilliant as some of those reported from foreign sources. In two cases no improvement seemed to be produced, the failure being possibly due to rejection of the remedy by the stomach. Gastro-intestinal irritation is frequently caused by pambotano.

Pambotano is reported to be also beneficial in diarrhœa, dysentery, leucorrhœa, and in certain diseases of the eye, as opacities of the cornea.

PANCREATINUM (U. S. P.).—**Pancreatin.**

Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Preparation.

Liquor Pancreatis (B. P.).—Pancreatic Solution. Dose, 4 to 15 c.cm. (or f3i-iv).

Pharmacology and Physiological Action.—Pancreatin is "a mixture of the enzymes naturally existing in the pancreas of warm-blooded animals, usually obtained from the fresh pancreas of the hog (Sus scrofa), or the ox, and consisting principally of **amylopsin,** the starch-converting enzyme; **myopsin** and **trypsin,** the enzymes that digest albuminoids; and **steapsin,** the enzyme that digests fat, and capable of converting not less than 25 times its own weight of starch into water-soluble substances, principally sugar, when tested by official process" (U. S. P.). It is presented in the form of a fine, white powder, and is a digestive ferment resembling pepsin in origin, mode of preparation, physical characters, and therapeutic uses. The product may be obtained in the form of a powder; but a better preparation is the British Pharmacopœia official pancreatic solution, made directly from the pancreas in diluted alcohol (20 per cent.), 1 part pancreas is minced or divided thoroughly by trituration with washed sand or powdered pumice stone and digested in 4 parts diluted alcohol.

Pancreatin is an efficient digestive agent in an alkaline medium, thus differing from pepsin. It will peptonize milk, gruel, oysters, and many articles of food, thus rendering them more easily digested and more nourishing for the invalid. As it emulsifies fat, it will aid in the assimilation of codliver-

oil and prevent its coming up in the throat. Trypsin will digest, and render soluble, mucous and fibrous deposits.

Therapy.—In diphtheria, a spray of trypsin, or of pancreatin solution, will dissolve the false membrane and favor its expulsion. A solution recommended for this purpose contains 2 Gm. (or 3ss) each of trypsin and sodium bicarbonate, with 4 c.cm. (or f3j) of glycerin to 30 c.cm. (or f℥j) of water. Dr. Samuel Johnson recommends the addition to this solution of corrosive sublimate, 0.015 Gm. (or gr. $^1/_4$) to 30 c.cm. (or f℥j). In hæmorrhage into the bladder, with the formation of clots, the deposit may be dissolved in the same manner as by the use of pepsin. If pancreatin be administered two hours after meals, it will assist intestinal digestion. It should be preceded by full doses of sodium bicarbonate, to insure an alkaline condition of the gastric contents. The pancreatin may be prescribed as follows:—

℞ Pulveris pancreatini ..... 4 | Gm. or 3j.
Hydrargyri chloridi mitis..... | 13 Gm. or gr. ij.
M. et ft. chartulæ no. xij.
Sig.: A powder two hours after meals.

℞ Liquor pancreatici (B. P.) ..... 90 | c.cm. or f℥iij.
Tinct. nucis vomicæ ..... 6 | 20 c.cm. or *mc.*
Glycerini ..... 60 | c.cm. or f℥ij.
M. Sig.: A tablespoonful after meals.

Pancreatin, or food peptonized by its action, is available in cases of enfeebled digestion due to severe and prolonged illness and in wasting disease. Pancreatin is of particular value, as suggested by Boas, in cases marked by great diminution of the gastric secretion. It is of service in some forms of enterocolitis, in constipation, and in diarrhœa with light-colored stools. It is frequently useful, moreover, in the vomiting of hysteria or pregnancy. This substance deserves trial in those cases of diabetes associated with disease of the pancreas. Pancreatin is particularly adapted for use in those diseases or conditions in which starch and fat are imperfectly digested. It is of service also, added to nutrient enemata, in cases where the stomach cannot retain or digest food. It may be used in the same manner in stricture of the œsophagus. Its alkaline reaction favors its efficiency. In the treatment of cancer, trypsin has been injected into the surrounding tissues, with good results, by Shaw Mackenzie, of London, and others. This treatment may be supplemented by internal administration of pancreatin and oxgall. **Trypsalin** is a specially devised product for use as a surgical solvent.

PAPAYA.—The Carica papaya (Passifloraceæ), or papaw, is a native of tropical America. The tree grows without branches to the height of twenty or twenty-five feet, and is crowned by long, large, palmate leaves. It bears a large melon-shaped fruit, of a yellow color when ripe and containing many seeds. In the trunk, leaves, and fruit is found an abundance of milky juice, from which Wurtz, of Paris, isolated a peculiar ferment, **Papain.** The attention of the profession was called to this new digestive agent, which converts albuminoids into peptones, starch into maltose, and emulsifies fats, by Dr. Finkler, of Bonn. Papain is soluble in water, though not in alcohol, but is active in either an acid or alkaline solution, and is more energetic than pepsin in dissolving false membranes. An aqueous solution of papain soon

spoils, but dissolved in glycerin it will keep for an indefinite period. It is best given, however, in powder or made into tablets.

M. Greshoff has extracted from papaw-leaves an alkaloid which he terms **Carpaine.** It forms large colorless crystals, readily soluble in chloroform and absolute alcohol, but much less soluble in ether, and insoluble in water. The hydrochlorate of this base is readily soluble in water, acts especially upon the heart, the movements of which it retards, and proved fatal to a fowl in the dose of 0.20 Gm. (or gr. iij). Carpaine is crystallizable and very bitter. Von Oefele states that it does not cause irritation or suppuration when hypodermically injected. It has been used as a substitute for digitalis in doses from 0.006 to 0.01 Gm. (or gr. $^1/_{10}$-$^1/_6$) daily for injections, or as high as 0.02 Gm. (or gr. $^1/_3$) by the mouth.

Marcano, of Bolivia, has found that a similar ferment, **Bromelin,** exists in pine-apple and other plants of the natural order Bromeliaceæ, and has applied it to the peptonizing of meat on a large scale, making a preparation of powdered beef, which is very easily digested, and the proteid matter of which consists of 50 per cent. of peptones. It is known as the *Mosquera-Julia* beef-meal. The juice of the fig and many other plants possess slight digestive powers, as beautifully shown in the well-known Dionæa, or Venus's fly-trap, and other members of the Drosera family, which Darwin found to secrete an acid juice which would digest small pieces of meat.

Therapy.—Papain has been used to dissolve the false membranes in diphtheria and croup, by the spray, and by a camel's-hair brush dipped in aqueous solution (2 or 4 Gm. to 30 c.cm., or gr. xxx to 3i-f℥j). Though it accomplishes this useful purpose, it has no power to prevent fresh formation of the membrane, unless associated with a strong antiseptic agent like corrosive sublimate, sulphurous acid, toluol, or menthol. An alkaline solution of papain has been found beneficial in fissures and ulcers of the tongue. A paint containing 3.24 Gm. (or gr. l) of papain and 1.62 Gm. (or gr. xxv) of borax to the ounce of water has been used with success in the treatment of warts and eczema squamosum chronica. Papain is claimed to have the power to dissolve intestinal worms. It has also been injected into the interior of tumors to promote absorption.

The late Dr. E. A. Wood, of Pittsburgh, employed papain, dissolved in glycerin, as a spray in ozæna, tuberculous ulcers of the larynx, and the cavities of pulmonary tuberculosis. He reported that in eight months of trial he had been "more and more convinced of its efficiency in the lesions named."

In the various forms of dyspepsia, papain has been employed with good effect. Grineritshi recommends papain[1] in habitual indigestion attended with acid eructations, painful symptoms of gastric fermentation, and constipation. He uses 0.13 Gm. (or gr. ij) of this drug in sugar of milk an hour or two after taking food. The following combination is suggested:—

℞ Papaini	2	Gm. or 3ss.
Liquor ammonii acetatis	60	c.cm. or f℥ij.
Creosoti	3	c.cm. or *m*v.
Glycerini	60	c.cm. or f℥ij.

M. Sig.: Two teaspoonfuls an hour or two after taking food.

It has been recommended, combined with bicarbonate of soda, in gastralgia, nausea, gastric and gastro-intestinal catarrh, diarrhœa due to in-

[1] *Bulletin Générale de Thérapeutique.*

digestion, etc. Sittmann has known papain to give rapid relief in acute gastritis. He witnessed improvement, likewise, in a chronic case of indigestion where an ulcer had undoubtedly existed at some period. In carcinoma of the pylorus this remedy gave marked relief. In dilatation of the stomach the use of papain is productive of decided benefit. In some cases the improvement has been so great that washing out the organ became unnecessary. In one case it was observed that the stomach diminished in size.

PARAFFINUM (U. S. P.), **PARAFFINUM DURUM** (B. P.).—**Hard Paraffin.** (See also page 707.)

A mixture of several of the harder members of the paraffin series of hydrocarbons; usually obtained by distillation from shale, separation of the liquid oils by refrigeration, and purification of the solid product. Insoluble in water, slightly soluble in absolute alcohol, almost entirely soluble in ether. It melts at 130° to 135° F. It is used as a base for ointments, for which it is well adapted, owing to the fact that it does not become rancid like ordinary fats.

Gersuny, of Vienna, in 1899, suggested the use of paraffin for prosthesis, or the correction of some defect by the subcutaneous injection of paraffin. A white petrolatum with a melting point of 40° C. (or 104° F.), is easily introduced through an appropriate syringe. It has been especially useful in restoring the shape of a saddle-back nose, as in cases reported by John W. Murphy (*Cincinnati Lancet Clinic,* March 14, 1903). The paraffin should be recently sterilized by boiling, and a syringe used that has a thread on the piston bar. Care must be taken not to inject while too hot, nor into a vein. A special syringe has been devised by Heath, of St. Paul, Minn., for this purpose.

PARALDEHYDUM (U. S. P., B. P.).—**Paraldehyde** ($C_6H_{12}O_3$).
Dose, 1.20 to 7.5 c.cm. (or *m*xx-f3ij).

Pharmacology.—Paraldehyde, chemically, is "a polymer of acetaldehyde," ordinarily produced by the action of a small quantity of sulphuric acid, or of zinc chloride, on ethyl aldehyde, or by conducting gaseous hydrochloric acid into aldehyde at ordinary temperatures. It is a colorless, mobile liquid, dissolving in 8 volumes of cold water, is less soluble in hot water, but dissolves freely in alcohol and ether; crystallizes below 32°, liquefies again at 51°, and boils at about 225° F.; has a burning, unpleasant taste and a penetrating, ether-like odor. It may be given with syrup and a vegetable bitter, or with aromatic water.

Physiological Action. — An hypnotic agent, exercising no depressing effect upon the heart in ordinary doses and causing no headache or disturbance of digestion. Paraldehyde is a good substitute for chloral, especially in low fevers or where the heart is weak. It is also diuretic, but not diaphoretic. The solid constituents of the urine, it is said, are not increased, though in the case of three boys to whom paraldehyde was experimentally administered, Gordon found a marked increase of urea. According to the writer just quoted, paraldehyde facilitates the digestion of fibrin. This substance is possessed of antiseptic properties. Death, preceded by unconsciousness and coma, has been caused by a dose of 22 to 26 c.cm. (or f3vi-vj) in a

patient suffering with typhoid fever.[1] A case has been reported in which 100 c.cm. (or f℥iiif℥iij) caused unconsciousness and profound muscular relaxation. The patient remained unconscious for thirty-four hours, but recovered by the aid of strychnine hypodermically, electricity, and stimulation. Dr. Frederic Peterson, of New York, mentions a case of paraldehyde habit in which a woman had taken doses of 30 c.cm. (or f℥j) nightly, for months, without any harmful result. On the contrary, bad effects have been seen in consequence of an 7.5-c.cm. (or f℥ij) dose taken for the first time. It is judicious to begin with small amounts. The fatal result from a toxic dose is attributed to its action upon the respiratory centre. Its principal influence is upon the cerebrum. In some cases it has been accused of producing albuminuria, but this might be explained by the presence of cirrhotic kidneys, with transitory attacks of albuminuria. Paraldehyde is very rapidly absorbed, and is eliminated by the lungs, its odor having been recognized in the breath twenty-four hours after administration. Paraldehyde is also eliminated by the kidneys and communicates its characteristic odor to the urine.

Paraldehyde is a physiological antidote to strychnine.

Therapy.—Bright's disease does not prohibit the use of paraldehyde. In such cases, where insomnia is persistent, the dose should be 2 to 2.50 c.cm. (or *m*xxx-xl) to commence with, given at the bed-hour, and cautiously increased to 4 c.cm. (or f℥j) if necessary. In the irritability, restlessness, and insomnia attending heart disease, 1.20 c.cm. (or *m*xx) may be given every four hours, with larger doses at night, with marked benefit. In bronchitis, pneumonia, and headache, paraldehyde is generally less useful than chloral hydrate and bromide, but in phthisis with persistent insomnia, in 2.50-c.cm. (or *m*xl) doses at bed-time, it produces a natural sleep lasting twelve hours. Some patients, however, complain of headache next day and persistent drowsiness, so that it soon has to be discontinued. Paraldehyde is, perhaps, particularly applicable to wakefulness associated with psychical disturbances. Very favorable accounts have been given by various observers of its beneficial influence in the cerebral manifestations of hysteria, in mania, melancholia, and the general paralysis of the insane. Paraldehyde is the preferred hypnotic[2] in the neurological clinic at Dorpat. It seldom fails to produce a good night's sleep, though, in some instances, tolerance is soon established. It may give rise to indigestion and diarrhœa, but its use is not followed by headache and depression. Paraldehyde has the disadvantage of communicating to the breath an unpleasant odor which may persist for hours or even days. Dr. J. G. Kiernan has known the continued employment of paraldehyde to occasion obstinate ulcers of the nose and eruptions upon the skin.

It has been used with advantage in delirium tremens, morphinism, and epilepsy. Several cases have been reported in which tetanus was cured by paraldehyde, which allayed the convulsions, diminished the pain, and relieved the insomnia. According to Dr. William Mackie, paraldehyde is beneficial in spasmodic asthma. Dr. Humphrey has witnessed decided improvement in the character of the respiration in broncho-pneumonia follow the administration of this remedy.

Dr. D. W. Aitken reports a case of epilepsy in which a prolonged aura

[1] *Lancet*, Aug. 20, 1890.

[2] "The Hypnotic Efficiency of Paraldehyde," *New York Medical Journal*, Nov. 29, 1890.

gave ample opportunity to prevent the attack, and in which from 1 to 2 c.cm. (or *m*xv-xxx) of paraldehyde always succeeded in keeping off the convulsions. "For more than a year she has had no fit except on one occasion, when there was no paraldehyde in the house."[1]

In asthma, paraldehyde affords rapid and complete relief in the majority of cases, the initial dose being 3 to 4 c.cm. (or *m*xlv-lx). A few cases need an additional dose of two-thirds this quantity an hour or so later. The hypnotic action of the drug is also especially valuable when the attack comes on at night, as noted by Dr. J. P. Hearder.[2]

Paraldehyde, in order to disguise its unpleasant taste, may be administered as follows:—

℞ Paraldehydi	15	c.cm. or f℥ss.
Olei gaultheriæ	60 or 1	20 c.cm. or *m*x vel xx.
Pulveris acaciæ	8	Gm. or 3ij.
Syrupi pruni Virginianæ	q. s. ad 120	c.cm. or f℥iv.

M. et ft. emulsio.

Sig.: A half to a tablespoonful in water every hour or two. Use as an hypnotic, or to lessen bronchial or pulmonary irritation.

Dr. R. G. Eccles suggests the following as a good method of administration:—

℞ Paraldehydi	7	5 c.cm. or f3ij.
Chloroformi		60 c.cm. or *m*x.
Olei cinnamomi		12 c.cm. or *m*ij.
Olei amygdal. dulc.	7	5 c.cm. or f3ij.

M. Sig.: Mix and take undiluted.

With the combined administration of caffeine (0.25 to 0.50 Gm., or gr. iv-viij, daily) and paraldehyde (2 to 3 c.cm., or *m*xxx-xlv, at night), Cevello found, in cases of œdema, ascites, and pleuritic effusion, that the amount of urine was greatly increased. A case has been instanced of senile arterial depression accompanied by dejection, restlessness, and insomnia, and in which extensive valvular disease of the heart was also present. Paraldehyde had an excellent effect upon the restlessness and insomnia, and when cardiac compensation began to fail it also rapidly reduced the dropsy.

PAREIRA (U. S. P.).—**Pareira (Pareira Brava).**

PAREIRÆ RADIX (B. P.).—**Pareira-root.**

Dose, 2 to 4 Gm. (or 3ss-j), in infusion (1-17).

Preparations.

Fluidextractum Pareiræ (U. S. P.).—Fluid Extract of Pareira. Dose, 2 to 4 c.cm. (or f3ss-j).

Extractum Pareiræ Liquidum (B. P.).—Liquid Extract of Pareira. Dose, 2 to 7.5 c.cm. (or f3ss-ij).

Pharmacology.—"The dried root of Chondodendron tomentosum" Menispermaceæ) is official as Pareira or Pareira-root; products of allied genera also appear in commerce under the name of "false Pareiras." It is a climbing, woody vine of Brazil, where it is extensively used as a medicine. Pareira

[1] *British Medical Journal*, 1896, p. 527.

[2] *British Medical Journal*, 1896, p. 725.

contains **Beberine,** a bitter, yellow alkaloid; also a soft resin, a proteid substance, calcium malate, potassium nitrate, and other salts. The alkaloid is identical with the beberine of Nectandra, and with **Buxine,** the active principle of boxwood; it has also been known as "pelosine," or "cissampeline."

Physiological Action.—Pareira is slightly tonic, but is esteemed principally as a diuretic and laxative, though, probably, without much reason.

Therapy.—It is principally used in fluid extract, decoction, or infusion, with alkalies, in the treatment of irritable bladder, cystitis, pyelitis, chronic urethritis, and leucorrhœa. In South America it is given internally for snake-bite, and applied externally to the wound.

PELLETIERINÆ TANNAS (U. S. P.).—**Tannate of Pelletiérine.** (See **Granatum.**)

Dose, from 0.20 to 0.50 Gm. (or gr. iij-viij).

PENTAL.—Under the name of pental (because it contains five atoms of carbon) von Mering has introduced a compound [**Trimethyl-ethylene** (C_5H_{10})] made by heating tertiary amyl alcohol with oxalic acid. Pental is a colorless liquid, of low specific gravity and strong odor, is volatile and inflammable, boils at 100.4° F., and is insoluble in water. It mixes in all proportions with alcohol, chloroform, or ether. It does not decompose on exposure to light and air.

Physiological Action.—When inhaled, a loss of sensibility occurs within two or three minutes without entire abolition of consciousness. Profound narcosis may, however, be produced by means of pental. The return of consciousness is gradual. This agent is unirritant to the respiratory tract, and no ill effects upon the circulation or respiration have, as yet, been reported. As a rule, no excitement is caused, but in some instances laughter, hallucination, or transient spasm has occurred.

From a series of physiological experiments upon dogs Dr. David Cerna concluded that pental causes a fall of arterial pressure and of the pulse-rate, and produces death mainly by cardiac paralysis. Recovery from its anæsthetic effects was often accompanied by wild excitement. He does not regard it as a safe or even efficient general anæsthetic. Pental rarely gives rise to headache or vomiting. The conjunctival reflex is late in disappearing, and, except fixation of the eyes, no marked change takes place in the color or expression of the face. The pupils are sometimes widely dilated. Pental may be administered upon a handkerchief or by means of an inhaler, and 7.5 to 11 c.cm. (or f℥ii-iij) usually suffice to produce anæsthesia.

Therapy.—Pental has been employed in the operations of dentistry and minor surgery. Hollaender and Weber have used it with satisfaction and success in the extraction of teeth, opening of abscesses, etc. Teeth may be painlessly drawn while the patient is partially conscious. Pental has been used in a large number of cases in the Kaiser und Kaiserin Friedrich's Children's Hospital of Berlin, without dangerous accidents or after-effects. From other sources, however, several deaths have been reported as caused by this agent. In a number of cases, moreover, Kleindienst detected albumin, blood, and casts in the urine after the administration of pental. Some patients have been observed in whom it proved impossible to produce anæsthesia by means of this agent. Alarming cyanosis, dyspnœa, and cardiac debility are sometimes caused by pental, and in a number of instances death has taken place from the inhalation of small quantities.

PEPO (U. S. P.).—**Pumpkin-seed.**

Dose, 4 to 15.5 Gm. (or ʒi-ʒss).

Pharmacology.—"The dried, ripe seed of Cucurbita Pepo" (Cucurbitaceæ), contains a resin (the active constiuent); a bland oil, starch, sugar, etc. The seeds may be crushed and beaten into a paste with milk and white sugar, and the resulting emulsion strained; or the seeds may be decorticated first and the contents rubbed up with sugar and milk, or sugar and water.

Therapy.—The principal medicinal use of pepo is for destroying tape-worms. It is generally efficient, cheap, and not very difficult to take. A preliminary purge of calomel should be given in the morning and the emulsion swallowed fasting at night. In the morning, a laxative (castor-oil, Rochelle salt, etc.) is administered, and the tape-worm is discharged, with the head. It is said that the resin (in doses of 1 Gm., or gr. xv) or the fixed oil (in doses of 15 c.cm., or fʒss) are also efficient when administered in the same manner. The combination of oleoresin of aspidium (or male fern) is very serviceable in destroying the tape-worm:—

℞ Oleoresinæ aspidii	4	c.cm. or f3j.
Chloroformi	60	c.cm. or *m*x.
Emulsion. peponis	360	c.cm. or fʒxij.

M. Sig.: To be divided into two doses, to be taken one hour apart, and followed by castor-oil an hour later.

PEPSINUM (U. S. P., B. P.).—**Pepsin.**

Dose, 0.32 to 0.65 Gm. (or gr. v-x).

Preparations.

Pepsinum Saccharatum.—Saccharated Pepsin (1 in 10). Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Glycerinum Pepsini (B. P.).—Glycerin of Pepsin (0.32 in 4 c.cm., or gr. v in f3j). Dose, 4 to 7.5 c.cm. (or f3i-ij).

Pharmacology. — Pepsin is a proteolytic ferment or enzyme obtained from the fresh stomachs of healthy pigs, and capable of digesting not less than three thousand times its own weight of freshly coagulated and disintegrated egg-albumin when tested by the official process. The British Pharmacopœia directs that the enzyme pepsin be obtained from the mucous lining of the fresh and healthy stomach of the pig, sheep, or calf; it should dissolve 3000 times its weight of hard-boiled white of eggs. Of the numerous methods employed for obtaining for medicinal use the digestive ferment from the gastric mucous membrane of certain domestic animals [hog, calf, sheep, principally] the most prominent are (1) scraping the acid mucous secretion from the surface of the stomach, spreading on glass and drying in scales [Beale]; (2) extracting by maceration in acidulated water and precipitation with alcohol or lead acetate, and (3) by precipitation with sodium chloride [Scheffer]. **Saccharated pepsin** is pepsin obtained from the gastric mucous membrane of the hog, mixed with sugar of milk. It is a white powder, of a peculiar, but not disagreeable, odor and taste, and a slightly-acid reaction. **Liquor pepsini** (non-official), or solution of pepsin, is an acidulated solution of the preceding, containing glycerin (40 per cent.). It is an artificial gastric juice, with an agreeable, acidulous taste; it should not become moldy, nor acquire a fetid odor when kept for some time. Many kinds of pepsin are upon the market, varying greatly in purity and digestive activity. Those

containing a considerable quantity of mucus, which have a strong odor of the pig-sty, and which possess only feeble digestive activity, when tested with boiled egg-albumin, should be rejected. Saccharated pepsin is really triturate of pepsin containing 1 part of pepsin with 9 of milk-sugar. Pepsin requires an acid medium in order to exert its digestive power upon albumin, while trypsin, or pancreatin, is active in a neutral or alkaline solution. On account of its instability, pepsin is best given uncombined. The substances with which it may be safely prescribed are few in number. As it is only active in an acid fluid, it should not be given with sodium bicarbonate.

Physiological Action.—Pepsin is a constituent of normal gastric juice, where it is associated with hydrochloric acid. It is an albuminous substance, capable of causing changes in other albuminoids by a process similar to fermentation, or catalysis, converting them into peptones or albumoses. It also converts blood-coagula, fibrin, etc., from the solid to the soluble or liquid state. It is an unorganized ferment, peculiar to gastric juice of the higher animals, although similar ferments have been discovered in carnivorous plants, and in the papaw, pine-apple, etc. Alcohol precipitates pepsin, and, even in dilute form, checks its activity. Alkalies and some mineral salts also precipitate it.

Therapy.—Pepsin, in concentrated solution, may be locally applied to digest blood-clots in the urinary bladder; and, in atomized solution or spray, to dissolve the false membrane in diphtheria and croup. In the latter affection the diphtheritic membrane may be treated with this solvent, containing pepsin:—

℞ Pepsini ..... 8| Gm. or ʒij.
Acidi hydrochlorici dil. ..... |60 c.cm. or *mx*.
Aquæ menth. pip.,
Glycerini ..... aa 15| c.cm. or fʒss.
M. Sig.: Paint over the surface frequently or several times a day.

A 5-per-cent. solution of scale-pepsin, in adeps lanæ, is a useful application to clean off old ulcers. Morris recommends a 10-per-cent. solution, acidulated with 1 per cent. of hydrochloric acid and heated to 100°-120° F., for washing out abscess-cavities, etc. In connective-tissue tumors of non-malignant character, pepsin may be used, by parenchymatous injection, to promote absorption. Mr. John Clay has seen good results follow the application of pepsin to cancer of the cervix uteri. He states that much of the neoplastic tissue may thus be destroyed, and that in some instances an apparently sound surface is obtained.

The chief use of pepsin is to aid weak digestion, and it is invaluable in atonic dyspepsia, especially following acute diseases. While the stomach should not be expected to depend entirely upon outside sources for its gastric juice, yet the temporary resort to pepsin is often followed by the best results. Given in this manner, pepsin acts, apparently, as a stimulant to the gastric glands and promotes their functional energy. In chronic maladies, such as anæmia, chlorosis, diabetes, tuberculosis, and carcinoma, the administration of pepsin is of service in promoting nutrition. In malnutrition foods may be partly peptonized previous to administration, thus saving time in stomach digestion. The use of peptonizing tubes, each containing sufficient for a pint of milk, is of great assistance in preparing such food, especially in the case of infants. In irritable stomach pepsin may be given in conjunction with bismuth subnitrate or minute doses of calomel:—

℞ Pepsini,
Bismuth. subnit. ..... aa 4| Gm. or 3j.
Olei cinnamomi ..... |75 c.cm. or *m*xij.
M. et ft. capsulæ no. xij.
Sig.: A capsule after meals.

℞ Hydrarg. chlor. mitis ..... |065 Gm. or gr. j.
Pepsini ..... 4| Gm. or 3j.
Pulv. myristicæ ..... |25 Gm. or gr. iv.
M. et ft. chartulæ no. xij.
Sig.: Take one every half-hour to relieve nausea and vomiting.

Pepsin is also useful in gastralgia, pyrosis, gastric catarrh, and apepsia of infants. In gastric cancer or simple ulcer, feeding may be carried on by the rectum, provided some pepsin be added to the nutritive enemata. But this remedy, when given by the mouth, is frequently of value in relieving the vomiting due to ulcer or cancer of the stomach. Sickness of the stomach, produced by indigestion, is generally relieved by pepsin, which is sometimes able, also, to allay the vomiting of pregnancy. Infantile diarrhœa, excited by the presence of undigested food in the intestinal tube, is markedly benefited by the administration of pepsin. The most satisfactory shape in which to administer pepsin to adults is in its pure form, as the saccharated pepsin is too weak to have much digestive power:—

℞ Pepsini ..... 4| Gm. or 3j.
Ext. nucis vomicæ ..... |32 Gm. or gr. v.
Pulv. ipecac. ..... |13 Gm. or gr. ij.
Pulv. aromat. ..... 1| Gm. or gr. xv.
M. et ft. pil. vel capsulæ no. xxx.
Sig.: Take one immediately after meals for atonic dyspepsia.

℞ Glycerini pepsini (B. P.) ..... 30| c.cm. or f℥j.
Acid. hydrochlor. dilut. ..... 4| c.cm. or f℥j.
Aquæ anethi ..... 45| c.cm. or f℥iss.
M. Sig.: Take a teaspoonful after meals for indigestion.

℞ Pepsini ..... 13| Gm. or gr. cc.
Strychninæ sulphatis ..... |015 Gm. or gr. 1/4.
Aloini ..... |13 Gm. or gr. ij.
Ol. menth. pip. ..... |06 c.cm. or *m*j.
M. et ft. capsulæ no. xx.
Sig.: A capsule after meals. For atonic dyspepsia accompanied by constipation.

Rennet-wine is obtained by macerating calves' stomachs in sherry or other light wines. It is useful in apepsia in infants. The glycerite of calf-pepsin is a more active and efficient preparation.

PEROXOLES.—Combinations of hydrogen peroxide with menthol, camphor, naphtol, carbolic acid, thymol, etc., have received the names of **menthoxol, camphoroxol, naphtoxol, carboxol, thymoxol,** etc. These combinations have been used in the dressing of wounds on account of their antiseptic and healing powers.

PERSIO.—Cudbear. A dark, purplish powder, prepared from certain lichens (Lecanora tartarea and other species). It is analogous to litmus, and yields a coloring matter to alcohol. It is principally used in dyeing. The tincture of cudbear is used as a coloring agent for liquids.

PETROLATUM (U. S. P.).—**Petrolatum.**

PETROLATUM LIQUIDUM (U. S. P.).—**Liquid Petrolatum.**

PARAFFINUM (U. S. P.), **PARAFFINUM DURUM** (B. P.).—**Hard Paraffin.**

PARAFFINUM MOLLE (B. P.).—**Soft Paraffin.**

Preparations.

Petrolatum Album (U. S. P.).—Petrolatum is a semisolid substance, consisting of hydrocarbons, chiefly of the marsh-gas series, obtained by distilling off the lighter and more volatile portions from petroleum and purifying the residue.

Petrolatum Liquidum (U. S. P.), Paraffinum Liquidum (B. P.).—Liquid Petrolatum, Liquid Paraffin.

Unguentum Paraffini (B. P.).—Paraffin Ointment (a mixture of hard and soft paraffin in the proportion of 3 to 7).

Benzinum (U. S. P.).—Petroleum Benzin. A distillate from American Petroleum, consisting of hydrocarbons, chiefly of the marsh-gas series.

Benzinum Purificatum (U. S. P.).—Purified Benzin (used in pharmacy in making deodorized tincture of opium and tincture of lactucarium.)

Rhigolene. (Used for producing cold by evaporation, chiefly from a spray.)

Pharmacology.—Petroleum is a very complex fluid, of natural origin, known from time immemorial, and found in various regions of the Old and New World. In this country the principal source of supply is the wells of Pennsylvania, though it exists also in Ohio, West Virginia, Texas, and Kentucky. Crude petroleum, though occasionally clear, usually presents a greenish-amber tinge. Its specific gravity varies from 0.777 to 0.865. Petroleum consists chiefly of two homologous series of isomeric hydrocarbons, at one extremity of which marsh-gas is found and solid paraffin at the other. It is not a fluid of definite composition or fixed boiling-point. American petroleum consists chiefly of paraffins. Barbadoes tar, Seneca oil, and Rangoon oil are thick varieties of petroleum. The Rangoon oil contains a larger proportion of both the olefine and the benzol series than American oil. Oxygen, nitrogen, and sulphur have been found in certain varieties of petroleum, but are present as impurities, though, according to H. Vohl, all kinds of petroleum contain sulphur. Petroleum does not saponify.

Naphtha, a name which was formerly applied to the lighter varieties of crude petroleum, is now used to designate all that portion which distills over at, or below, 122° F. By repeated fractional distillations the most volatile hydrocarbons are obtained from naphtha. **Benzin** consists of the more volatile portions, being very inflammable, and yields vapors, which, if combined with air, are explosive. Coal-oil, used for illuminating purposes, consists of less volatile hydrocarbons, which should not flash or evolve explosive vapors under a temperature of 150°.

Petrolatum, petrolatum-jelly, or paraffin ointment, is a semisolid substance, consisting of hydrocarbons, chiefly of the marsh-gas series ($C_{16}H_{34}$, etc.), obtained by distilling off the lighter and more volatile portions from American petroleum and purifying the residue. It is an amorphous, pale-yellowish, odorless, tasteless, or nearly so, translucent, fatty substance, in thin layers more or less fluorescent. Petrolatum is insoluble in water, scarcely soluble in cold absolute alcohol, soluble in 64 parts of boiling absolute alcohol, soluble in ether, chloroform, fixed and volatile oils. Special forms of

petrolatum are applied under the names of cosmolin, vaselin, albolene, etc. It does not become rancid, and is used as a basis for ointments as a substitute for lard. It is also official as a liquid oil (petrolatum liquidum).

Physiological Action.—Petroleum possesses decided antiseptic power, is stimulant, and, taken internally in small quantities, is antispasmodic, diaphoretic, and expectorant. It disinfects the gastro-intestinal and respiratory mucous tracts. In large doses it gives rise to headache, vertigo, pain in the throat and stomach, palpitation of the heart, vomiting, tetanic spasm, and may cause death. The inhalation of the lighter hydrocarbons, benzin, gasoline, and naphtha, causes intoxication and stupor.

The vapor of naphtha has some irritating qualities to mucous membranes, and produces œdema of the eyelids. In a case reported by Dr. J. Leidy, Jr., a man was rendered unconscious by breathing the vapors of naphtha from a tank, which he was set to work to clean

Therapy.—Rock-oil enjoys considerable popular repute both as an internal and external remedy. As a counter-irritant it is used in chronic rheumatism, synovitis, sprains, chilblains, and paralysis. It is likewise applied to the neck or chest for inflammatory affections of the throat and air-passages. Crude petroleum is a beneficial application in diphtheria. It may be painted upon the affected surface with a camel's-hair brush or by means of a pledget of absorbent cotton. Patients who are old enough may also use it as a gargle. The false membranes are reproduced, but are much smaller and thinner than before the application. Mr. Sydney Turner, of Gloucester, England, suggests, also, that petroleum be vaporized in the room occupied by patients suffering from diphtheria. Larcher has employed this agent in a series of forty-two cases, with only two deaths and without an instance of communication of the disease to any other person. Of the fatal cases one was moribund when first seen and in the second his directions were not obeyed.

Crude petroleum is useful in certain forms of conjunctivitis. It is a painless application and is well borne by the cornea. In granular conjunctivitis (trachoma) it may be rubbed upon the affected surface with a stiff brush. Petroleum is useful in ordinary catarrhal conjunctivitis and in follicular ophthalmia. It is of service in some cases of trachoma, while in others it fails.

Petroleum, alone or combined with other drugs, has been employed in psoriasis, eczema, seborrhœa, scabies, and almost every variety of skin disease. In eczema, Kaposi recommends the following:—

℞ Petrolei ..... 15 c.cm. or f℥ss.
Emplast. plumbi ..... 15|5 Gm. or ℥ss.

Dissolve and thoroughly incorporate with the aid of heat, and add a little oil of bergamot to flavor, if desired.

Sig.: Apply to the affected surface on soft cotton or linen.

Desprès advocates the use of petroleum as an application to ulcerated carcinoma of the breast. In uterine cancer he has found that vaginal injections of 90 to 120 c.cm. (or f℥iii-iv) of petroleum answer a good purpose. He recommends the same procedure in acute vaginitis.

The stimulating properties of petroleum render it of service in loss of hair and alopecia circumscripta. Petrolatum has been widely employed as an unguent, and as a basis with which to incorporate more active topical

medicaments. It is cleanly, devoid of odor, is not subject to alteration, and is available when the object is solely to cover the integument with a bland protective layer. It frequently happens, however, that petrolatum contains irritant constituents which have not been removed in the process of manufacture, and which render this substance useful as a stimulant ointment.

When it is desired that a fatty material should penetrate the skin, one of the animal fats—as lard, suet, butter, or adeps lanæ—is entitled to the preference as an ointment base.[1]

Liquid petrolatum is available as an application for bougies, catheters, and other instruments. It has also been employed, by means of the atomizer, in inflammatory conditions of the nares, and after operations upon these and other parts of the body. Liquid petrolatum has also been used as a menstruum for suspending various substances in it, for external and internal use. Some clinicians have been incorporating certain of the mercurial salts in liquid petrolatum and employing the combination for hypodermic injections into the tissues.

Internally, the crude oil has been given, in the oil regions, in teaspoonful doses to children suffering with croup and whooping-cough, with asserted good results. It is occasionally given in chronic bronchial and pulmonary disorders with advantage. The inhalation of naphtha-vapor has been recommended in asthma.

Petroleum, administered by inhalation and internally in the form of an emulsion, has been strongly recommended as of value in pulmonary tuberculosis.

It is employed in Germany as a vermifuge; dose, 1.20 to 2 c.cm. (or *m*xx-xxx). The finer qualities of petroleum have been given with success in cholera in similar doses.

Rhigolene, one of the lightest products of the distillation of petroleum, is an extremely volatile fluid, boiling at about 64 $^1/_2$° F. So great is the rapidity of its evaporation, that local temperature is depressed to 15° F. by a spray of rhigolene. The fluid should be kept in a cool place and in tightly-corked bottles. It can be used with a hand-atomizer to produce cold for local anæsthesia, as a substitute for ether. Rhigolene sprayed upon the skin soon deadens sensibility and facilitates the performance of any brief surgical operation. Its garlicky odor and inflammability are objections to its use, except in the histological laboratory, where it is employed to freeze specimens for section-cutting. Paquelin's thermocautery is fed by one of the lighter hydrocarbons of petroleum.

PETROSELINUM.—Parsley. The root of Petroselinum sativum (Umbelliferæ) contains a camphoraceous substance, **Apiolin**; a neutral principle, **Apiin,** soluble in alcohol and water; also a volatile oil. Parsley-root is carminative, diuretic, emmenagogic, and slightly laxative, and stimulates the circulation, the skin, and bronchial mucous membrane. The alcoholic solution of a petrol-ethereal extract leaves behind, upon evaporation, a product which, if treated by caustic soda, yields a thick, reddish liquid, which boils at 275° C. (527° F.), and has a specific gravity of 1.113. To this oily substance, which is the true active principle of the plant, M. Chapoteaut has given the name **Apiolin.** It is dispensed in capsules of 0.18 c.cm. (or

[1] See "Diseases of the Skin," 1901; also "Ointments and Oleates," second edition, pp. 244, 245.

*m*iij) each. A third principle, termed **Cariol,** has been extracted from the same source by Morgues and Laborde. The apiol of commerce appears to be a mixture of volatile oil and resin, with apiin, apiolin, and cariol in uncertain proportions. Apiol is also known as "Parsley camphor." It is the dimeth-oxy-methylene ether of allyl-tetraoxybenzene.

Physiological Action.—Thrown under the skin or into the veins of guinea-pigs, cariol determined genital hyperæmia, increased urination, and, subsequently, general tremors and slight convulsions, paresis or motor incoordination, and, finally, death from asphyxia. The spinal cord in the dorsolumbar region was markedly congested. The uterine vessels of a bitch became engorged when cariol was injected into the circulation. Apiol and cariol possess a similar action upon the nervous and circulatory systems. The former causes a rapid rise of arterial pressure, due to increased action of the heart and stimulation of the vasomotor centres in the medulla oblongata. Cariol exerts a less powerful influence upon the circulation than apiol. Both principles, and especially cariol, promote muscular excitability. Apiol causes congestion of the uterus and ovaries, and favors the occurrence of the menstrual discharge. Both apiol and cariol possess excitomotor properties, and their physiological action justifies their employment in genito-spinal atony.[1] Mr. H. C. Whitney considers that the volatile oil is the true emmenagogic principle. From poisonous doses of apiolin Laborde observed somnolence, stupor, paresis, motor inco-ordination, accelerated respiration and circulation, and death from asphyxia. Small doses act upon unstriated muscular fibres, especially those of the uterus, almost invariably causing abortion in pregnant guinea-pigs.

Therapy.—The fresh root of parsley is preferred, of which a hot infusion is administered in amenorrhœa and dysmenorrhœa. Parsley is also useful as a diuretic in dropsy, strangury, gonorrhœa, etc. Owing to a favorable report from a commission of the French Academy, apiol for a time was employed in malarial affections as a substitute for quinine, but, being found to be much inferior in antiperiodic action, it is at present seldom prescribed, except as an emmenagogue. In cases of scanty or deficient menstruation, with pains, etc., 0.18 to 0.30 c.cm. (or *m*iii-v) in a capsule can be given after meals, thrice daily, for a week before the expected period. Apiol is especially appropriate when amenorrhœa depends upon anæmia. It may be given in combination thus:—

℞ Apiolini	3|10	c.cm. or *m*l.
Aloini	|065	Gm. or gr. j.
Sulphuris subl.	3|25	Gm. or gr. l.

M. et ft. capsulæ no. x.

Sig.: A capsule night and morning a week before and during the menstrual period. Indicated in amenorrhœa and dysmenorrhœa.

In cases of pronounced anæmia the action of the apiolin will be more decided if a ferruginous preparation be given with it and continued in the intervals between the menstrual periods.

Apiolin regulates the menstrual flow, and thereby indirectly relieves the pain of congestive or spasmodic dysmenorrhœa. It is useful likewise in atonic amenorrhœa. This remedy may be administered with advantage in all cases amenable to the influence of internal medication.

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[1] *La Tribune Médicale*, Nos. 2, 3, and 4, 1891.

PHENACETINUM (B. P.).—**Phenacetinum.**

ACETPHENETIDINUM (U. S. P.).

Dose, 0.32 to 0.65 Gm. (or gr. v-x).

Pharmacology.—A coal-tar product [$C_2H_5OC_6H_4NHCOCH_3$] para-acet-phenitidin, occurring in white, crystalline powder, of slightly bitter taste, without odor; soluble in alcohol, glycerin, lactic acid, and sparingly in water. It is not toxic in ordinary doses, and is less frequently followed by dangerous depression, than is the case with some other members of the aromatic group of coal-tar products. The drug should be chemically pure.[1]

Dr. Ludwig Reuter, of Heidelberg, has pointed out that a dangerous impurity is found in some samples of phenacetin, resulting from imperfect conversion of paraphenetidin into phenacetin. The contamination may be detected by melting a small quantity of chloral-hydrate in a test-tube to the heat of boiling water and adding one-fifth of phenacetin. If the latter be pure the mixture remains colorless, but if paraphenetidin be present a purple color develops, passing rapidly from red into blue. Paraphenetidin has produced serious toxic effects in small doses, inflammation of the kidneys being observed in several cases.

Phenacetin can, according to Hinsberg, be distinguished from acetanilid and antipyrin by finely pulverizing and heating it to ebullition with nitric acid (1 to 10). An orange color is thus produced with phenacetin, while the other substances give no reaction when treated in the same manner. Fulmer (*Annales der Chimie Analytique,* 1905) gives the following test for acetanilide in phenacetin: One decigramme of the suspected substance is boiled for one minute with 1 c.cm. of concentrated hydrochloric acid. The mixture is diluted with 10 c.cm. of water, and filtered. To the filtrate are added three drops of a 2-per-cent. solution of chromic acid. If the phenacetin is pure, the solution assumes a ruby-red color, which is permanent. If it contains acetanilide, the solution assumes a dark green tint, and later a deposit is observed.[2]

Physiological Action.—A nervous sedative, with little effect upon the circulation. In very large amounts, Hare claims that it is more apt to disintegrate the blood than antipyrin, but its influence upon other vital functions is not so severe, and it is therefore less dangerous. Phenacetin is not, however, totally devoid of toxic influence. Cases have been reported in which vomiting, collapse, cyanosis, vertigo, profuse sweats, and an urticarial rash have followed its administration. According to the experiments of Drs. David Cerna and William S. Carter, moderate amounts of phenacetin act upon the heart, causing a rise of arterial pressure, and probably exert also a stimulant effect upon the vasomotor system. In large doses the drug reduces blood-pressure, the reduction being mainly of cardiac origin. Dr. Hirschmann, of Vienna, has observed that after the administration of phenacetin, an abundance of crystals was sometimes found upon the skin. Under the microscope they exactly resembled the crystals of phenacetin, which had been given to the patient.

Phenacetin slightly reduces normal bodily heat, but more decidedly when pyrexia is present. It acts upon sensory nerves and relieves pain and

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[1] *Pharmaceutical Record,* Dec. 1, 1890.

[2] *American Druggist,* Dec. 11, 1905.

spasm. In some cases an hypnotic effect seems to be produced. It favors the action of the skin and kidneys, but is not decidedly diuretic.

Therapy.—Phenacetin was originally introduced into medical practice as an antipyretic, and subsequently was found to possess analgesic powers, resembling antipyrin in this respect. In diseases attended by hyperpyrexia, such as rheumatism, pneumonia, typhoid fever, and phthisis pulmonalis, phenacetin exerts a very happy effect in about half the dosage of antipyrin, the ordinary dose being from 0.20 to 0.50 Gm. (or gr. iii-viij). The fall of temperature does not occur until half an hour after the drug has been taken, and the reduction continues for four to eight hours. As an antipyretic it is considered by many good authorities as the safest and most efficient member of the aniline group. Good results are said to be produced in malaria by a combination of phenacetin with small doses of quinine.

In epidemic influenza, phenacetin rapidly relieves the muscular pains and favors diaphoresis; the catarrhal symptoms subsequently require other remedies. A combination of 0.25 Gm. (or gr. iv) of phenacetin with 0.20 Gm. (or gr. iij) each of salol and sulphate of quinine has been highly extolled. The dose is repeated every two or three hours until the pains have subsided. In the nervous sequelæ of this disease the late Dr. William F. Hutchinson, of Providence, believed that phenacetin stands first in the list of remedies.

In ordinary colds, one or two powders (0.32 Gm., or gr. v) of phenacetin rapidly remove all the symptoms. Where fever is present, the combination of salol with phenacetin is especially useful in influenza and rheumatism. The analgesic effects of phenacetin are very marked in various forms of headache, including migraine and the headaches from eyestrain, having the advantage over antipyrin in less frequently causing a rash.

The following combination is recommended as beneficial in migraine:—

℞ Acetphenetidini	3	Gm. or gr. xlv.
Caffeinæ citratæ	20	Gm. or gr. iij.
Quininæ hydrochloridi	65	Gm. or gr. x.
Benzosulphinidi (saccharin)	01	Gm. or gr. $^1/_6$.

M. et div. in chartulæ no. x.
Sig.: One powder at a dose.

In the neuralgic pains of tabes dorsalis, in herpes zoster, and intercostal neuralgia, small doses, given every hour for three or four hours, usually afford complete relief and cause sleep. Phenacetin is extremely useful in chronic neuritis, and, according to Kater, is unsurpassed in the treatment of cerebral disorder due to excessive indulgence in alcoholic drinks.

In whooping-cough 0.03 Gm. (or gr. ss) doses, dissolved in 10 drops of glycerin, are readily taken by children, and afford prompt relief, permitting sleep and ameliorating the attacks.

In delirium a dose of 0.65 Gm. (or gr. x) will usually afford a quiet night. Franz Mahnert[1] considers phenacetin a specific in acute articular rheumatism, as it reduces fever, relieves pain, and lessens the duration of the attack. It has been found useful in some cases of gonorrhœal rheumatism, and is worthy of more extended trial in this rebellious affection. Given several hours before the time of the paroxysm of intermittent fever, it prevents the chill, but not its recurrence. In insomnia from simple exhaustion,

[1] "Annual of the Universal Medical Sciences," 1890, vol. v, p. A-105.

phenacetin acts admirably. The late Dr. Traill Green, of Easton, Pa., found phenacetin of service in checking the frequent micturition of old people. It did not appear to be necessary to administer the remedy continuously in order to obtain the desired result.

Dr. M. H. Lees, of Knoxville, Tenn., reports that the local application of finely powdered phenacetin is efficacious in promoting the healing of traumatic, simple, and syphilitic ulcers.

Phenacetin has also been employed locally in an alcoholic solution or in ointment in cases of rheumatic pains of joints.

Among the many compounds belonging to the aromatic series and related to phenacetin, the following are important:—

Lactophenin.—A substance bearing this name and closely related to phenacetin has been studied by Landowsky. Lactophenin differs chemically from phenacetin in containing lactic instead of acetic acid. It is a white, rather bitter powder, sparingly soluble in water. Lactophenin reduces abnormal temperature, but exerts little or no influence upon the circulation and respiration. This substance has been given in pneumonia, influenza, erysipelas, scarlatina, acute tuberculosis accompanied by fever, and in septicæmia. It has been employed by von Jaksch in typhoid fever with satisfactory results; the doses were from 0.50 to 1 Gm. (or gr. viii-xv). Roth has found it of value in acute rheumatism. Lactophenin was useful in some cases of chorea and in the pains of locomotor ataxia.

Landowsky ascertained that it possessed value as a remedy in neuralgia. He states, moreover, that it exerts a genuine hypnotic effect. It was given in daily doses ranging from 0.65 to 3 Gm. (or gr. x-xlv). In some cases it gave rise to diaphoresis and slight vertigo.

Apolysin.—This compound differs from phenacetin in the substitution of a citric-acid radical for the acetic-acid radical. It is a white or yellowish-white, crystalline powder, with an acrid taste, soluble in warm water, less so in cold (about 1 to 50). It has been claimed that, while it possesses the antipyretic and analgesic effects of phenacetin, it is innocuous even in large doses. This is questioned by David Cerna,[1] who has seen bad results and even death, in the lower animals, following the administration of apolysin. While not toxic in ordinary doses (1.30 to 2 Gm., or gr. xx-xxx), yet care should be exercised in its use in larger quantities.

Methacetin.—This compound differs from phenacetin only in containing a methyl in place of an ethyl group. Methacetin occurs in the form of colorless, scaly crystals, is comparatively non-toxic, and has the advantage of being five times more soluble in water than phenacetin. Methacetin possesses antiseptic properties and has been given in typhoid fever and pneumonia. In pulmonary tuberculosis its action was not favorable, as it gave rise to copious night-sweats. It has also been employed in neuralgia.

Dulcin (Paraphenetolcarbamide).—On account of its remarkably sweet taste, the name dulcin has been given to a substance the chemical composition of which allies it to phenacetin. It has also been termed **sucrol.** Dulcin crystallizes in the form of small, white tables, which are soluble in alcohol and ether, in 50 parts of hot water, and 800 parts of cold water.

Dulcin has a pure, sweet taste, and is said to be from 200 to 250 times sweeter than saccharose. Its effects have been studied by Kobert, Kossel,

[1] *Journal of the American Medical Association,* June 20, 1896.

and Paschkis. It is without influence upon rabbits. In the daily dose of 2 Gm. (or 3ss) it did not disturb digestion in the rabbit or dog. It had no effect upon the respiration, circulation, or central nervous system. Large doses had a toxic influence upon dogs, which died with such evidence of blood-destruction as icterus. In experiments upon cats, Kobert concluded that doses corresponding to those which may be employed in the human being are without danger. In abnormally large doses, cats sicken and sometimes die with cerebral symptoms. The same manner of death has been observed in frogs subjected to subcutaneous injections of dulcin.

Aldehoff dissents from the observers above quoted, having found daily doses of 1 Gm. (or gr. xv) harmful and even, in the course of a few weeks, fatal to dogs, which died with symptoms of acute jaundice.

Dulcin has been used in the place of sugar to sweeten the food of obese individuals, in whom it is desirable to limit the amount of saccharine food. It can be employed in small doses with advantage in diabetes mellitus. Ewald has given it in daily doses of 1.55 Gm. (or gr. xxiv). It is regarded as innocuous when administered in moderate amounts.

Phenocoll is derived from glycocoll, or amido-acetic acid, and phenetidin, the water being abstracted. The new combination is a phenacetin, which, by the introduction of the salt-forming amido group in the acetyl radical, is rendered readily soluble. The hydrochloride is soluble in about 16 parts of water at 17° C. (62.6° F.), and the solution is of neutral reaction. The salt crystallizes out of hot water in cubes similar to those of antipyrin; out of alcohol, in which it readily dissolves, it crystallizes in needles.

The pure base, phenocollum purum, may be obtained by the action of ammonia, caustic alkali, or alkaline carbonate upon a solution of the salt, and occurs in the form of white, matted needles, which contain 1 part of water of crystallization. Hydrated phenocoll melts at about 95° C. (203° F.), the anhydrous form at 100.5° C. (212.9° F.). On account of its solubility in cold water, the salt is preferable to the pure base for use in medicine. Phenocoll is fairly stable when boiled in a dilute solution of an alkaline caustic or carbonate, though prolonged boiling causes it to separate into phenetidin and glycocol. It is similar in its behavior toward weakened acids. After long boiling in concentrated hydrochloric acid, it is partly split up into phenetidin hydrochlorate and glycocoll.

Phenocoll hydrochloride has a salt taste, with a sweetish after-taste and an aromatic odor, and is best administered in the form of powder. The aqueous solution, neutral at first, develops an alkaline reaction at the end of the second day. It is the salt most frequently used. The acetate, carbonate, and the salicylate of phenocoll have also been prepared. The first-named salt is easily soluble in water, and has been recommended as being well adapted to hypodermic use.

Physiological Action.—Phenocoll exerts no deleterious influence upon animals, and does not affect the composition of the blood. A dose of 1.50 Gm. (or gr. xxiij) was followed by no evil consequences in the rabbit.

The physiological action of this drug has been studied by Drs. Cerna and Carter, who conclude that in ordinary amounts it is practically without effect upon the circulation, that large doses diminish the blood-pressure by influencing the heart, that phenocoll reduces the pulse-rate by stimulating the cardio-inhibitory centres. It then increases the rapidity of the pulse by paralyzing those centres. The final diminution is of cardiac origin. Upon

the blood itself phenocoll has no action. Phenocoll reduces temperature by causing an enormous diminution of heat-production without any alteration of heat-dissipation.

In the human subject it is well tolerated by the stomach, and seems to have no injurious effect upon the kidneys. After ingestion of about 5 Gm. (or gr. lxxv) the urine assumes a brownish or blackish-red color. The coloration usually deepens when the urine is left long exposed to the air. Upon the addition of tincture of ferric chloride, the color becomes still darker. The drug is eliminated rapidly, and twenty-four hours after discontinuance the reaction with the tincture of iron can no longer be obtained. Dr. P. Balzer, as a result of experiments conducted in Professor Eichhorst's clinic, states that phenocoll favors the elimination of nitrogen.

Therapy.—Thirty-two cg. (or gr. v) of phenocoll hydrochloride have reduced temperature in typhoid fever and pneumonia 3° F. or more without causing collapse or cyanosis. In the hectic fever of phthisis, Dr. Hertel found that 0.50 Gm. (or gr. viij) doses, thrice repeated at hourly intervals, reduced temperature 1° C.; 1 Gm. (or gr. xv) doses effected a diminution of 1 $^1/_2$° C. within a few hours, and the reduction continued for about two hours. Five Gm. (or gr. lxxv), given in divided doses throughout the day, occasioned an almost complete defervescence. In acute inflammatory rheumatism Hertel found daily doses of 5 Gm. (or gr. lxxv) valuable in the alleviation of pain, but with little direct influence upon the fever. As soon as pain was abolished, however, the temperature fell to normal. Sweating was occasioned, and in some instances Cohnheim observed chilliness to attend the reascent of temperature. In two cases Dr. P. Balzer witnessed cyanosis as a result of the administration of daily doses of 4 or 6 Gm. (or ʒi-iss) of phenocoll. In some instances phenocoll was successful when other antirheumatic remedies had failed. Cohnheim obtained no good results from its use in chronic rheumatism, and in the hands of Hertel it produced no effect upon a case of gonorrhœal rheumatism. Professor Eichhorst has made use of phenocoll in typhoid fever, and states that the remedy seems to exercise a favorable influence on the symptoms, and the course of the disease becomes milder. Professor Albertoni states that he has extensively employed phenocoll in malaria, and that excellent results were effected in a number of severe cases. Phenocoll is sometimes successful in malarial cases when quinine has proved ineffective. In malaria the remedy was given six or seven hours before the expected paroxysm in the dose of 1 Gm. (or gr. xv). Phenocoll occasions no unpleasant after-effects, and its taste is easily disguised by mixing it with sugar. A combination of phenocoll and quinine will sometimes prove efficacious in subduing an obstinate attack of malaria which has resisted either remedy when administered alone.

It is claimed that phenocoll is particularly applicable to the treatment of malarial infection in pregnant women.

Cohnheim found the remedy efficacious in a number of cases of neuralgia, especially when due to influenza. It was of no service in hysteria or bronchial asthma.

Doses of 0.50 Gm. (or gr. viij) have produced a good result in migraine. Dr. Modigliani has employed this remedy in juvenile cases. He found it advantageous in chorea and convulsions and in various febrile disorders.

Dr. Q. C. Smith, of Austin, Texas, writes that he has found nothing more efficient in the treatment of hectic fever than the following combination:—

℞ Phencoll. hydrochloridi,
Salicin. ..... aa 3|10 Gm. or gr. xlviij.
Hydrastinæ sulph. ..... 1|55 Gm. or gr. xxiv.
M. et ft. capsul. no. xxiv.
Sig.: One capsule every four to eight hours.

Dr. Carl Beck, of New York, has convinced himself by clinical experiments that phenocoll is possessed of antiseptic virtues and has used it externally in various cases, embracing accidental and surgical wounds, inflamed and suppurating cases, etc. As a dry dressing, he at first used the pure powder, but subsequently found that a 10-per-cent. gauze answered the same purpose. A 5-per-cent. watery and a 10- or 15-per-cent. alcoholic solution were of advantage in certain cases. A 10- or 20-per-cent. ointment was applied to ulcers and burns, but, though the results were good, the healing process seemed to take longer than under the use of gauze. An injection of a 10-per-cent. alcoholic solution reduced the size and relieved the pain of a cancer, rendering desirable additional trials in the same direction. Phenocoll has the advantage of being inodorous and not productive of irritation or inflammation of the skin.

Salocoll. — Phenocoll salicylate has been given, for convenience, the above name. Salocoll is obtained by the action of salicylic acid upon phenocoll hydrochloride, occurs in the form of a powder, has a sweetish taste, and is not easily soluble in water. It is given in the dose of 1 or 2 Gm. (or gr. xv-xxx), and can be repeated twice or thrice during the day. Salocoll has been shown to possess antipyretic, antirheumatic, and antineuralgic properties, and has been thought to be especially useful in influenza.[1]

PHENALGIN is a coal-tar derivative, ammonio-phenylacetylamid ($C_6H_5NH_3$). It is used as an antipyretic and hypnotic, and is said to be a vascular stimulant. [Is liable to be confused with a proprietary of the same name, which is an acetanilide mixture.] Doses are about the same as acetphenetidinum.

PHENAZONUM (B. P.), **ANTIPYRINA** (U. S. P.).—**Antipyrin.** Phenyl-dimethyl-iso-pyrazolone.

Dose, 0.32 to 1.30 Gm. (or gr. v-xx). **Ordinary dose,** 0.20 to 0.32 Gm. (gr. iij-v).

Pharmacology.—Antipyrin is a synthetical product belonging to the aniline series, discovered by Dr. Ludwig Knorr, who obtained a patent for the process of preparation, but the time for its exclusive control in the United States has expired, and it is now official. It is a white, crystalline powder, of a slightly-bitter taste, freely soluble in water, alcohol, and chloroform, and less readily soluble in ether. Antipyrin melts at 113° C. (235.4° F.). A solution of antipyrin added to a solution of ferric chloride gives rise to a dark-brown color. With spirit of nitrous ether it shows a green color-reaction, and is changed into iso-nitroso-antipyrin.

Physiological Action.—Upon the unbroken integument it is devoid of effect, but upon denuded or ulcerated surfaces its solution is said to exert an analgesic influence. Small doses do not ordinarily produce marked results, either in animals or healthy men. Excessive doses cause slight depression

[1] *The American Therapist*, June, 1893.

of the normal temperature, cyanosis, chilliness, cardiac debility, and diaphoresis. Given to animals, it occasions epileptiform and tetanic convulsions. Reflex movements are increased by small and decreased by large doses. Antipyrin depresses the functions, both of sensory and motor nerve-trunks. Lethal quantities cause, in frogs, arrest of the heart in diastole. Arterial tension is decreased by large doses, unless convulsions occur, in which case it is increased. Small doses augment blood-pressure. The effect upon the blood-pressure is due to the direct stimulant or depressant influence of small or large doses upon the heart. A solution of antipyrin applied to divided blood-vessels arrests hæmorrhage. Respiration is unaffected by small doses; is first increased, but subsequently markedly decreased, by toxic doses. In fevered animals it causes a decided reduction of temperature, possibly by a direct action upon the heat-centres. Toxic quantities give rise to methæmoglobin in the blood. Antipyrin is possessed of some antiseptic power, and arrests fermentation. Absorption and elimination are rapid. Antipyrin is removed from the system by the kidneys, the urine being sometimes diminished and sometimes increased in quantity.

It is said that, under the influence of antipyrin, the urine contains a lowered proportion of substances representing nitrogenous tissue-change. Large doses cause a considerable decrease in the quantity of urine excreted.

Idiosyncrasy and Toxicology. — Many unpleasant and alarming, with sometimes fatal, effects have followed the administration of medicinal doses of antipyrin. Among these consequences are vomiting, profuse sweating, cyanosis, collapse, salivation, dyspnœa, and epileptiform convulsions. Dr. Perdriel suggests that antipyrin will be better tolerated by the stomach if prescribed with sodium bicarbonate and tartaric acid in capsules, owing to the influence of the nascent carbonic acid evolved.

The late Dr. P. Guttmann reported a case of poisoning from antipyrin, in which the symptoms approximated those of the algid stage of cholera. The fæcal evacuations were, however, formed. The quantity taken had been 10 Gm. (or ʒiiss) in divided doses.

Herpetiform eruptions have been observed after the use of antipyrin. In some cases, again, small erosions or ulcerations have been produced. Morel-Lavallée has reported a case in which the prolonged ingestion of antipyrin occasioned the development, upon the middle of the tongue, of a large spot of erosive glossitis which closely resembled agminated mucous patches of the tongue. Cutaneous eruptions due to antipyrin assume in different cases the form of erythema, urticaria, or pemphigus. At times a rash similar to that of measles is produced. This is easily removed by administering belladonna with the antipyrin or by giving an hypodermic injection of atropine. In some cases, the eruption appears on the penis in the form of black blotches accompanied by œdema, as reported by Fournier.[1] The eruption appeared four and one-half hours after the first dose was taken. The patients were alarmed, thinking that gangrene of the penis would follow.

M. Verneuil has, in two instances, observed partial gangrene follow the hypodermic injection of antipyrin. When nutrition is lowered this agent should not be injected at the seat of disease.

A number of fatal cases have been reported from medium doses of antipyrin, especially in children, old persons, and those suffering from cardiac

[1] *Annales de Dermatologie et de Syphiligraphie*, April, 1899.

debility or disease. In such cases, therefore, the remedy must be used, if at all, with extreme caution. Poisoning is shown by restlessness, anxiety, slow respiration, weak pulse, and vertigo. Treatment is by diffusible stimulants, heart-tonics (strophanthus or nux vomica), and artificial respiration or inhalation of oxygen. Atropine will also aid in the treatment. Heat favors, while cold retards, the action of antipyrin. A habit of antipyrin addiction is sometimes acquired and produces serious disturbance of the health, manifested by nervous irritability, loss of appetite, and decided impairment of nutrition.

Incompatibles. — Phenol, chloral-hydrate, gallic acid, spirit of nitrous ether, calomel, the preparations of cinchona; hydrocyanic, nitric, and tannic acids; copper sulphate, ferrous sulphate, corrosive sublimate, sodium salicylate, tincture of ferric chloride, syrup of ferrous iodide, tincture of iodine, catechu, kino, and rhubarb.

Therapy.—The therapeutic effects of this substance may be summed up as antipyretic, analgesic, and antispasmodic. When antipyrin is given in febrile states, the temperature begins to descend, at the end of half an hour to an hour, and reaches its lowest point of descent in three to five hours. The average time during which the temperature remains depressed is from six to nine hours. It is preferable to administer the drug in a few large doses rather than in small amounts repeated. It should always be borne in mind, however, that large quantities are apt to produce collapse. The descent of temperature is usually, but not always, accompanied by profuse diaphoresis. In place of sweating, increased diuresis is sometimes observed.

Antipyrin is of especial value in hyperpyrexia. It may be used with advantage in previously vigorous subjects, in disease of a sthenic type, when fever is, in itself, a source of danger. In typhoid fever the best authorities oppose resorting to this class of antipyretics to reduce temperature. It may be used in typhus fever, small-pox, and yellow fever. In scarlatina, accompanied by excessively high fever, we may have recourse to antipyrin. It has been found beneficial in erysipelas, reducing fever and apparently limiting the spread of the disease. In croupous pneumonia it reduces the rate of respiration as well as the temperature, but has no influence upon the pulmonary inflammation. Antipyrin is efficacious in the pneumonia and bronchitis of children. According to the comparative studies of the late Professor Demme, of Berne, relative to the use of antipyretics in the treatment of the febrile diseases of children, antipyrin is of particular value in cases of broncho-pneumonia in which relapse and excessively high temperature are quite marked. He employed, in the first period of recurrence, antipyrin in aqueous solution, with a little sugar and a few drops of cognac. When given in this form it very seldom produces disturbance of the stomach, and very rarely fails to effect the desired reduction of temperature.[1] In the fever of pulmonary tuberculosis antipyrin is seldom likely to prove of advantage, on account of its depressant properties. In intermittent fever it is capable of reducing the fever, but not of preventing recurrence. Some writers have ascribed very excellent results to the use of this drug in puerperal fever.

Antipyrin is of efficacy in acute and subacute articular rheumatism, and is not infrequently successful in those cases in which sodium salicylate has failed. It not only reduces the fever, but also relieves the joint affections.

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[1] See *Medical Bulletin*, March, 1891, p. 95.

Favorable reports have been made as regards its action in gout. Potter mentions a case in which an acute paroxysm of gout was ameliorated and shortened by antipyrin. A dose of 1.60 Gm. (or gr. xxv) was given at first, and was followed by 0.65 Gm. (or gr. x) doses every second hour until decided relief was obtained. In chronic gout, also, it is reported to exert a beneficial influence. The acute paroxysm is ameliorated and shortened, and the course of the chronic form modified.

Antipyrin is efficacious in relieving pain in the various forms of neuralgia, but as a rule has little effect upon that due to inflammatory diseases. It is of particular avail when the neuralgia depends upon a gouty or rheumatic taint. It relieves the pain of malarial neuralgia, but will not prevent a recurrence of attacks. Hemicrania is often markedly relieved by the administration of this remedy.

According to Dr. Græme M. Hammond, it is especially efficacious in that form of migraine characterized by local heat of skin, flushed face, and dilatation of the temporal artery. The same author recognizes its usefulness in sick headache due to dietetic errors. A mixture or combination of antipyrin, caffeine, and citric acid is recommended as of marked efficacy in various forms of neuralgia, given in 1 Gm. (or gr. xv) doses. Excellent results have been obtained in sciatica from the use of antipyrin, especially when combined with quinine. It will often assuage the lancinating pains of locomotor ataxia. Pleuritic pains and the chest-pains of phthisis may be relieved by means of antipyrin. It has been used in dysmenorrhœa with asserted good success, and it has also been employed with a view to mitigating the pains of labor. Antipyrin has also been successfully employed to assuage the pain of hepatic colic.

The internal use of antipyrin is advocated by Blaschko in cases of pruritus dependent upon hysteria or other functional disorders of the nervous system. His statements have been confirmed by the experience of other observers.

Antipyrin mitigates the severity of a number of affections characterized by spasmodic action. In hysterical tremors and in chorea it is often of service. It has been seen to alleviate the paroxysms of whooping-cough, and in some instances it has seemed to shorten the course of the disease. C. G. Kerley has given antipyrin (combined with bromide of soda) in over 400 cases of pertussis. The antipyrin was given usually combined with syrup of raspberry. It is not depressing when given with any degree of intelligence; in fact, it is well borne by children in good-sized doses, and it controls whooping-cough better than any other drug used by him. The paroxysms are diminished in number from one-third to one-half without any amelioration of the individual seizure, or the seizures are less severe without any change in the number of the attacks. In some both the severity and number were favorably influenced. In all the cases the disease was made easier in some way. It was found that the two drugs given together more effectually controlled the disease than when either were given separately. At the out-patient department of the Babies' Hospital he used the drugs combined in the form of a compressed tablet. For a child 8 months of age 0.03 Gm. (or gr. ss), of antipyrin, with 0.13 Gm. (or gr. ij) of bromide of soda, is given at two-hour intervals. For a child of 15 months 0.065 Gm. (or gr. j) of antipyrin and 0.16 Gm. (or gr. iiss) of bromide of soda at two-hour inter-

vals. Two and a half to 4 years, 0.13 Gm. (or gr. ij) of antipyrin and 0.20 Gm. (or gr. iij) of bromide of soda at two-hour intervals.[1]

Galvagno praises the action of antipyrin combined with resorcin, and states that the duration of pertussis is decidedly abridged by the administration of a mixture composed as follows:—

℞ Resorcinolis,		
Antipyrinæ	aa 1	Gm. or gr. xv.
Syrupi simplicis	30	c.cm. or f℥j.
Syrupi acaciæ	105	c.cm. or f℥iiiss.

M. et ft. sol.

Sig.: From three to five dessertspoonfuls each day.

In many cases of epilepsy, antipyrin is efficacious in reducing the number of convulsions. It is said to be particularly useful in epilepsy occurring at the menstrual epoch. Its value is enhanced by a combination with ammonium bromide, and it may be given, in the dose of 0.50 to 1 Gm. (or gr. viii-xv), thrice daily, with 1.30 Gm. (or gr. xx) of the latter drug. The mixture has been continued for long periods without producing bromism. Dujardin-Beaumetz and others have observed benefit from the use of antipyrin, in daily doses of 2 to 2.60 Gm. (or gr. xxx-xl) in diabetes mellitus. In diabetes insipidus, also, good results have been reported. Antipyrin has been used, with asserted good results, by Dr. M. H. Feeny in subacute Bright's disease, and by Dr. Saint-Phillippe in infantile diarrhœa, accompanied by pain and indigestion. Alexandre Paris treated a case of tetanus successfully by means of antipyrin. Its favorable action in tetanus has been confirmed by Caviana and Venturoli. M. Clément considers it of value in promoting absorption of serous effusions in pleurisy, and it is said to allay the pain of glaucoma.

M. Guibert asserts that antipyrin arrests the secretion of milk, and may be safely administered for this purpose in doses of 0.25 Gm. (or gr. iv) every two hours. Others have successfully employed it for the same purpose. M. B. Martin has observed good effects from its use in exophthalmic goitre, urticaria, erythema nodosum, and senile pruritus. Dr. Gaudez has called attention to its usefulness in cases of idiopathic incontinence of urine in children. He combines a small quantity of sodium bicarbonate with each dose and lays stress upon the importance of administering the remedy at six and eight o'clock in the evening. He is accustomed to give the remedy in full doses according to age. It has been observed that in persons taking antipyrin the liability to take cold is increased. Antipyrin has given relief in some cases of lead colic. On account of its hæmostatic, antiseptic, and analgesic properties, antipyrin has proved an efficacious local remedy in a number of affections. Epistaxis is arrested by the application of the powder or an aqueous solution of 10 or 20 per cent. strength. The bleeding is checked without the formation of a clot. It is available after extraction of teeth, operations in the mouth, and in minor surgery. Dr. Garner has reported a case in which uterine hæmorrhage yielded to an aqueous solution of antipyrin (4 Gm. to 60 c.cm., or 5i-f℥ij, of cold water) applied to the canal of the womb by means of a cotton swab. It has been used as an injection in hyperæsthesia or neuralgia of the urethra and bladder, and likewise in gonorrhœa. For use in gonorrhœa a solution may be made of 2 Gm. to 240 c.cm.

[1] *Archives of Pediatrics*, April, 1900.

(or 3ss-Oss) of water. In cystitis the injection of a 4-per-cent. solution of antipyrin allays pain and checks spasmodic contractions. The fluid is allowed to remain within the bladder for ten minutes. In hypertrophy of the prostate gland the use of antipyrin, either administered by the mouth or brought into direct contact with the mucous membrane, diminishes the frequency of desire and renders the act of micturition more easy and less painful. Antipyrin is also of benefit in nephralgia as well as in painful organic affections of the pelvis of the kidney and the ureter, as inflammation, the presence of foreign bodies, etc.

A 5- to 15-per-cent. solution has been found an efficacious application in conjunctivitis, purulent dacryocystitis, trachoma, and pannus. Dr. E. B. Gleason has reported favorable results from the application of antipyrin in inflammatory conditions of the mucous membrane of the upper respiratory tract.[1] He found that the analgesic effect of solutions continues for several hours, and may apparently be prolonged indefinitely if reapplied at intervals. Antipyrin diminishes the reflex cough and asthma excited by certain nasal affections. Solutions of 1 to 3 per cent. generally give good results when used with an atomizer inside the nose. To the posterior wall of the pharynx a concentrated solution may be applied. Strong solutions may also be applied with benefit in cases of laryngitis. In painful laryngeal tuberculosis Dr. Neumann has advantageously insufflated a mixture of equal parts of antipyrin and powdered starch.

A solution of antipyrin, either alone or combined with cocaine hydrochlorate, has been recommended as an efficacious topical remedy in painful affections of the nose, pharynx, and larynx, as well as in cases of operations upon those parts.

Dr. J. Buisson has observed an admirable effect in nocturnal enuresis from the administration of three 0.65 Gm. (or gr. x) doses of antipyrin at hourly intervals, beginning four hours before bed-time.

M. Vianna has ascertained that antipyrin is destructive to the bacillus of Löffler and its toxic products. He, therefore, suggests that the drug may prove useful in the treatment of diphtheria.[2]

A mixture of antipyrin and salol, or antipyrin-salol, has been found efficacious as a local application in uterine hæmorrhage. The fluid, applied with cotton, is said to be free from danger, to cause no pain, and to have an hæmostatic and antiseptic action.

A valerianate of antipyrin and quinine has also been prepared.

Salipyrin is a combination of salicylic acid and antipyrin. This substance can be made by gradually adding 73.4 parts of salicylic acid to a boiling aqueous solution of 100 parts of antipyrin. On cooling, salicylate of antipyrin is thrown down in the form of colorless, transparent crystals or scales, which are very slightly soluble in cold water, but readily soluble in alcohol, ether, or chloroform. According to Hitschmann, it is only in rare instances that even large doses of salipyrin occasion a fall of blood-pressure.

The experiments of Alberto on frogs and toads show that small doses of salipyrin increase the power of the heart, medium doses produce arhythmia, while large quantities cause arrest in diastole.

Salipyrin was used by Guttmann in doses of 4 Gm. (or 5j) or more in twenty-four hours, given in doses of 1 Gm. (or gr. xv), the first dose to be

[1] *New York Medical Journal*, Oct. 29, 1892.
[2] *Le Progrès Médical*, April 2, 1892.

double: 2 Gm. (or gr. xxx). It had decided antipyretic and analgesic action, and was especially useful in the pyrexia of rheumatism and intermittent fevers. Salipyrin has sometimes succeeded in cases of acute rheumatism after the failure of sodium salicylate and antipyrin. In other cases, again, it has not seemed to exert a decided influence. It seems to be of little avail in chronic rheumatism. In epidemic influenza it relieves the severe headache, and often has a decided sedative and hypnotic effect. Professor Mosengeil, of Bonn, esteems salipyrin of value in the treatment of catarrhal affections unrelated to influenza. He recommends that the remedy should be administered at the inception of the attack. In chronic nasal catarrh he has had good results from insufflation of powdered salipyrin. Hitschmann states that its most marked action is that of an analgesic. He has given it with benefit in chronic myelitis with lancinating pains in the lower limbs, in sciatica and other forms of neuralgia. He observes that it will sometimes cause derangement of the stomach or abundant perspiration. An eruption upon the skin and tinnitus aurium occurred in a few cases after its use. Kayser has employed salipyrin with advantage in a number of cases of uterine hæmorrhage. In nearly all the cases it produced a hæmostatic effect, which continued for several days after the drug had been discontinued. It was particularly useful in menorrhagia preceding the menopause. Salipyrin has likewise been used with good effect in amenorrhœa.

Migrainin, or Migranin, is a mixture of antipyrin, 89.4 per cent.; caffeine, 8.2 per cent.; citric acid, 0.56 per cent.; moisture, 1.84 per cent. Prof. C. A. Ewald speaks highly of this combination in sick headache; it is also useful in influenza, for relieving pain in the head.

Naphthol-antipyrin.—M. G. Patein has succeeded in combining antipyrin with both alphanaphthol and betanaphthol, the former being a liquid and the latter a crystallized substance.

Tolypyrin. — This name has been given to a synthetical preparation which differs from antipyrin by the substitution of a molecule of the methyl group for one of the hydrogen atoms in the phenyl group. Tolypyrin is a colorless, crystalline substance, of a bitter taste, soluble in water and alcohol, but almost insoluble in ether. It is colored violet by ferric chloride and green by sodium nitrate, potassium nitrate, and by sulphuric acid. According to the investigations of Dr. von zur Mühlen, toxic doses of this compound paralyze the central nervous system, but do not directly destroy the irritability of the cardiac muscular tissue. Clinical experiments were first made with this compound by Dr. Paul Guttmann, who found that it reduced the temperature in typhoid fever, pneumonia, scarlatina, facial erysipelas, and phthisis. It was given in four doses of 1 Gm. (or gr. xv) each at hourly intervals. Tolypyrin lessens the pain and swelling of rheumatism. No untoward effects have been observed from its use, and it is eliminated in the urine. It is also beneficial in neuralgia. Dr. Dornblüth has employed tolypyrin with advantage in neuralgia and other varieties of nervous pains and also in inflammatory pains, as angina and alveolar abscess, nervous insomnia, headache after epileptic attacks, and nocturnal enuresis in children.

Tussol.—This name is given to a compound of amygdalic acid and antipyrin. Tussol is said by Dr. Rehn to be useful in whooping-cough, reducing the frequency and severity of paroxysms. The substance is soluble in water and is given in doses of 0.048 to 0.10 Gm. (or gr. $^3/_4$-iss) two or three times

a day to children less than one year of age. From the second to the fourth year doses ranging from 0.23 to 0.38 Gm. (or gr. iii$^{3}/_{4}$-vj) may be employed, and for older children 0.50 Gm. (or gr. viij). No ill effects have yet been reported from its administration.

Ferripyrin.—This designation has been bestowed upon a double combination of ferric chloride and antipyrin. Dose, 0.50 Gm. (or gr. viij).

PHENOL (U. S. P.).—**Phenol.** (See **Acidum Carbolicum.**)

PHENOLPHTHALEIN ($C_{20}H_{14}O_4$) is a brown powder of definite composition obtained from coal-tar. It is used in the chemical laboratory in making test solutions. It has been found that it exerts a laxative effect, generally without griping, in doses of one to two grains once daily. It is usually given in tablets each containing one grain (.06 Gr.). It may be combined with Strychnine and belladonna as in the following: ℞ Phenolphthalein gr. j; Strychnine sulphate gr. $^{1}/_{500}$; Ext. Belladonnæ foliorum gr. $^{1}/_{100}$.

PHENYLIS SALICYLATIS (U. S. P.).—**Phenyl Salicylate, or Salol** (See **Salol.**)

PHOSPHORUS (U. S. P., B. P.).—**Phosphorus.**
Dose, 0.00048 to 0.00065 Gm. (or gr. $^{1}/_{150}$-$^{1}/_{100}$).

Preparations.

Zinci Phosphidum (U. S. P.).—Zinc Phosphide. Dose, 0.0025 to 0.006 Gm. (or gr. $^{1}/_{24}$-$^{1}/_{10}$).

Acidum Hypophosphorosum Dilutum (U. S. P.).—Diluted Hypophosphorous Acid (10 per cent.). Dose, 0.60 to 2 c.cm. (or *m*x-xxx).

Acidum Phosphoricum (U. S. P.).—Phosphoric Acid (not less than 85 per cent., by weight, of absolute orthophosphoric acid).

Acidum Phosphoricum Dilutum (U. S. P., B. P.).—Diluted Phosphoric Acid (U. S. P. containing, by weight, 10 per cent. of orthophosphoric acid). Dose, 1.20 to 4 c.cm. (or *m*xx-f3j).

Oleum Phosphoratum (B. P.).—Phosphorated oil (1 per cent., in expressed almond oil). Dose, 0.06 to 0.20 c.cm. (or *m*i-iij).

Pilulæ Phosphori (U. S. P., B. P.).—Phosphorus Pills. [Each pill (U. S. P.) contains 0.0006 Gm., or gr. $^{1}/_{100}$; of the B. P. mass 0.25 Gm., or gr. iv, contains 0.0013 Gm., or gr. $^{1}/_{50}$, or 2 per cent.] Dose, 1 to 2 pills. B. P., 0.065 to 0.13 Gm. (or gr. i-ij).

Acidum Phosphoricum Concentratum (B. P.).—Concentrated Phosphoric Acid (contains 66.3 per cent. of hydrogen orthophosphate).

Spiritus Phosphori.—Spirit of Phosphorus. A solution of phosphorus (1.2 Gm.) in absolute alcohol (to make 100 parts). Dose, 0.3 to 1 c.cm. (or *m*v-xv).

The U. S. P. official hypophosphites are of lime, iron, potassium, and sodium; their preparations are:—

Syrupus Hypophosphitum (U. S. P.).—Syrup of Hypophosphites (contains of the lime salt, 45; sodium and potassium salts, 15 each; spirit of lemon, 5; diluted hypophosphorus acid, 2; sugar, 500; and water, q. s. ad 1000 parts). Dose, 4 to 30 c.cm. (or f3i-f3j).

Syrupus Hypophosphitum Compositus (U. S. P.).—Compound Syrup of Hypophosphites (1 part each of ferrous lactate and potassium citrate added to the preceding enough to make 100 parts). Dose, 4 to 30 c.cm. (or f3i-f3j).

The official U. S. P. phosphates are of iron (also pyrophosphate of iron), sodium (and sodium pyrophosphate), and the precipitated calcium phosphate. The preparations are:—

Elixir Ferri, Quininæ, et Strychninæ Phosphatum.
Glyceritum Ferri, Quininæ, et Strychninæ Phosphatum.

Liquor Sodii Phosphatis Compositus (U. S. P.); Sodii Phosphus Effervescens (U. S. P.); and Sodii Phosphas Exsiccatus (U. S. P.).

Syrupus Calcii Lactophosphatis (U. S. P., B. P.).—Syrup of Calcium Lactophosphate (contains the precipitated carbonate, lactic acid, orange-flower water, sugar, phosphoric acid, and water). Dose, 4 to 15 c.cm. (or f3i-iv). B. P., 2 to 4 c.cm. (or f3ss-j).

Syrupus Ferri, Quininæ, et Strychninæ Phosphatum (U. S. P., B. P.).—Syrup of the Phosphates of Iron, Quinine, and Strychnine. Dose, 2 to 4 c.cm. (or f3ss-j).

Pharmacology.—Phosphorus, a non-metallic element, was obtained by Brandt, in 1669, by decomposition of urine. It is a soft, flesh-colored solid, very inflammable, oxidizing upon exposure to the air; the British Pharmacopœia directs that it be obtained from calcium phosphate. Phosphorus melts at 110° F., and friction causes it to ignite at ordinary temperature. It possesses an alliaceous odor, is insoluble in water, sparingly soluble in alcohol, ether, and chloroform; more soluble in oils, and dissolves readily in carbon disulphide. Occurs in nature as tribasic phosphate of lime in primitive and volcanic rocks, and in the bones of vertebrates. The official (U. S. P.) requirement is that it shall contain not less than 99.5 per cent. of the pure substance. It should be kept carefully under water in a cool place.

Physiological Action.—In brain- and nerve- tissue it exists in combination with fat as lecithin; and in all vascular structures, in the form of tribasic phosphate, it is an important constituent. It is excreted in small quantity normally by the urine in the form of phosphates; occasionally, when oxidation is interfered with or an excess of phosphorus introduced into the blood, it is excreted in its own form by the breath, urine, and perspiration, making the person luminous. Phosphorus is likewise eliminated by the liver. In medicinal doses the action of phosphorus upon the nervous system is that of a tonic and stimulant, and it also accelerates cell-growth in organs and tissues and particularly in the skin. Phosphorus is stated by Binz to produce its effects by causing the development of active oxygen in cell-protoplasm, the process being compared with what occurs when phosphorus is exposed to air with the production of ozone. On the circulation it acts primarily as a stimulant, making the pulse fuller and more frequent; the capillary expansion is flushed, and free perspiration follows; as a consequence, the temperature of the surface is at first slightly raised, but subsequently falls several degrees. Small doses of phosphorus have a favorable influence upon the composition of the hæmoglobin; immoderate quantities have a deleterious effect. The kidneys are also flushed, the quantity of urine becomes larger, the proportion of urates and urea is decidedly increased; hæmaturia often results from a poisonous dose. No influence is observed upon digestion from small doses, though larger ones cause irritation. Muscular power is enhanced and sexual appetite stimulated. Mental operations are easily performed, and it is said tactile sensibility is heightened. The body-weight is increased. Jaundice may occur from interference with the functions of the liver, and biliary acids may appear in the urine. Purpura is sometimes due to the administration of phosphorus. Wegner has shown that phosphorus also exerts a marked influence in promoting the growth of bone. Phosphorus in substance is very inflammable and produces extremely painful burns.

Toxic Effects.—In single poisonous doses, phosphorus is a violent irritant, causing gastric inflammation; and, if death does not quickly occur, fatty degeneration of muscular tissues and acute yellow atrophy of the liver

will follow. This result may also succeed the medicinal use of phosphorus, when continued too long, or if the dose be considerable. Nebelthau[1] reported a case of a child two years of age, that had taken only 3 mgr. (or gr. $^1/_{20}$) of phosphorus in the course of sixty hours, in solution in codliver-oil. Fatal intoxication occurred, and the characteristic changes were found post-mortem. When the poisonous action is very slow, as where workmen are exposed to the fumes of phosphorus in making friction-matches, the toxic effects are shown by the death of certain bones, particularly the jaw-bone. Ralph Stockman has demonstrated, however, that phosphor-necrosis, so called, is really due to a mixed infection of tubercle bacilli with pus-forming micro-organisms. The condition of the jaw is precisely analogous to tuberculosis of the jaw in cattle. Moreover, these cases generally die with pulmonary phthisis.[2]

Acute Phosphorus Poisoning. — When, as not rarely happens, an infusion of match-heads is swallowed, or phosphorus-paste[3] used for poisoning rats is taken with suicidal intent, or an overdose of a medicinal preparation of crude phosphorus is swallowed, the first symptom is pain and burning at the epigastrium, with vomiting. The vomited matter and even the stools are sometimes phosphorescent, with intestinal irritation and purging; death may occur from exhaustion. The blood is robbed of its oxygen, becomes black, unusually liquid, and loaded with products of decomposition; the capillary tissues yield and the extravasations of blood produce purpura, hæmaturia, and hæmorrhages. Jaundice is frequent, and convulsions and coma are not uncommon. Temperature is reduced. The urine is usually scanty and albuminous. In some instances it has contained sugar. After the development of jaundice, bile-acids and biliary coloring matter make their appearance in the urine. In women fatal doses generally cause a bloody discharge from the uterus, and if pregnancy exists the drug occasions abortion. One and a half grains of phosphorus have proved fatal. Taylor reports the death of a lunatic after gr. $^1/_8$ had been taken.

Antidotes.—Copper sulphate may be used freely as an emetic, followed by a purge of magnesia or magnesium sulphate to clear the intestinal canal. Albuminous and mucilaginous drinks, in which magnesium hydrate is suspended, are useful. Oil, being a solvent of phosphorus, should be avoided. Old French oil of turpentine, which contains oxygen, was formerly held to be a chemical antidote. Oxygen inhalations have been proposed to overcome the depression due to altered blood. Hydrogen dioxide has also some antidotal power. Professor Bokai recommends potassium permanganate as an antidote to poisoning by phosphorus. In the stomach, manganese chloride is formed with the liberation of oxygen and the conversion of phosphorus into orthophosphoric acid. He advises the use of a $^1/_3$-per-cent. solution of permanganate. At a later period alkalies are useful.

If the poison has been retained for a time, death will occur from fatty degeneration of the stomach, liver, and other organs. Phosphor-necrosis may be prevented by thorough ventilation of the work-room, or by the

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[1] *Munch. Med. Woch.*, Aug. 20, 1901.

[2] *British Medical Journal*, Jan. 7, 1899.

[3] Phosphorus-paste, for destruction of house vermin, is made by rubbing together 6 parts of phosphorus and sulphur with 6 parts of cold water until they liquefy. Then add 2 parts of mustard-flour, 8 parts of sugar, and 12 of rye-flour, making a paste. To be kept closely stoppered in tin boxes. Phosphorus matches each contain $^3/_5$ mgr. of red phosphorus.

workmen wearing masks or respirators, covering the mouth and nose, and obliging them to have their teeth in good condition, as carious teeth are the immediate cause of this form of necrosis, as already stated. The error in diagnosis may be made of mistaking phosphorus poisoning for acute yellow atrophy of the liver of unknown etiology.

Therapy.—In neurasthenia, or nervous debility, where the system is weakened by anxiety, overwork, or sexual excesses, and in neuralgia, phosphorus is a valuable tonic and restorative, but has less control over pain than many other agents. It is sometimes given with success in herpes zoster. In small doses, continued for considerable periods, it is of service in arresting fatty degeneration of the heart and ameliorating the symptoms due to that condition. Phosphorus is of value in supporting the system when exposed to severe and prolonged bodily or mental strain. Phosphorus is not infrequently of service in the treatment of angina pectoris. In reduced nutrition of nervous centres this remedy is valuable, as in atheroma of the cerebral vessels, white softening, insomnia of the aged, hysterical paralysis and melancholia, morphinomania, and chronic alcoholism. It checks sweating due to nervous debility. Phosphorus may be employed as a restorative after typhoid fever or typhoid pneumonia, and phosphorated oil is said to be valuable in intermittent fever. In anæmia small doses in conjunction with iron are of considerable service. In so-called pernicious anæmia, or anhæmatosis, small doses of phosphorus seem to have some influence in checking the progress of the disease. In rickets and osteomalacia, also, clinical experience has pronounced in favor of phosphorus, especially in the form of oleum phosphoratum given with codliver-oil.

℞ Olei phosphori (B. P.) ..... 1| c.cm. or *m*xv.
Ol. morrhuæ ..... 120| c.cm. or f℥iv.
M. Sig. : A teaspoonful to a tablespoonful four times a day.

The following prescriptions are recommended by Kassowitz in the treatment of rickets in children :—

℞ Phosphori ..... |01 Gm. or gr. 1/6.
Benzosulphinidi ..... 5|13 Gm. or gr. lxxvij.
Olei limonis ..... |12 c.cm. or *m*ij.
Ol. morrhuæ ..... 105| c.cm. or f℥iiiss.
M. Sig.: Dose, a teaspoonful.

℞ Phosphori ..... |01 Gm. or gr. 1/6.
Olei olivæ ..... 28| c.cm. or f℥vij.
Acidi oleici ..... 2| Gm. or gr. xxx.
Sach. alb.
Pulv. acaciæ ..... aa 15|5 Gm. or ℥ss.
Aq. dest. ..... 105| c.cm. or f℥iiiss.
M. Dose, a teaspoonful.

Thomson uses:—

℞ Phosphori ..... |065 Gm. or gr. j.
Alcoholis (absolut.) ..... 22| c.cm. or *m*cccl.
Spt. menthæ pip. ..... |60 c.cm. or *m*x.
Glycerini ..... q. s. ad 60| c.cm. or f℥ij.
M. Sig.: Six to twelve drops, after meals, three times daily.

When, in eruptive fevers (in scarlatina, measles, etc.), the exanthem does not come out, or it recedes, the administration of phosphorus has been resorted to with advantage. In some instances phosphorus will render good

service in the exhaustion of typhoid and typhus fevers. Travignot, Squire, and other writers have used this remedy with advantage in diabetes mellitus. In scanty and irregular menstruation attended with headache, the continued administration of phosphorus exercises a beneficial influence on the character of the periods. Phillips commends the action of phosphorus in cases of hysteria, dependent upon sudden shock as well as those connected with delayed or suppressed menses.

In skin diseases, phosphorus and its compounds are useful as substitutes for arsenic, and in some cases are superior to this drug. In crops of boils, acne indurata or inveterata, and eczema of nervous origin, calcium phosphate or the alkaline hypophosphites are highly serviceable.

In lupus erythematosus, Dr. L. D. Bulkley often prescribes:—

℞ Phosphori ..... | 38 Gm. or gr. vj.
Alcohol. absolut. ..... 111 | c.cm. or f3xxx.

Dissolve with heat and agitation and mix, while still warm, with the following mixture, also warm:—

Glycerin ..... 285 | c.cm. or f℥ixss.
Alcohol. ..... 45 | c.cm. or f℥iss.
Spiritus menth. pip. ..... 15 | c.cm. or f℥ss.

M. Each drachm contains 0.003 Gm. (or gr. $^1/_{20}$) of phosporus. Dose, 10 to 15 drops.

Phosphates and Hypophosphites.—In some cases, medicinal doses of phosphorus cause feebleness of the heart's action with threatening collapse or acute gastric pain, and, in others, fatty degeneration of the muscles and viscera. This does not occur after using the salts of phosphoric and hypophosphoric acids and their preparations. The phosphates have physiological actions and therapeutical powers differing from those of phosphorus. Sodium phosphate, for instance, is a valuable cholagogue and is slightly laxative, making it of special service in treating children who pass clay-colored fæces, and also in catarrhal jaundice, owing to its action upon the liver. It is of benefit in rheumatism, either alone or combined, thus:—

℞ Sodii phosphat.,
Acidi salicylici ..... aa 6 | 50 Gm. or gr. c.

M. et ft. capsulæ no. xx.
Sig.: A capsule or two every two hours for rheumatism.

A saturated solution of sodium phosphate may be used in tablespoonful doses as a purgative.

For gout and rheumatism, Dr. F. L. Satterlee recommends the following prescription also containing the sodium phosphate:—

℞ Lithii benzoat. ..... 2 | Gm. or 3ss.
Sodii bromid.,
Potassii carbonat. pur. ..... aa 8 | Gm. or 3ij.
Potassii acetat. ..... 46 | 5 Gm. or ℥iss.
Sodii phosphat. ..... 15 | 5 Gm. or ℥ss.
Syr. zingiberis,
Aq. menth. pip. ..... aa 180 | c.cm. or f℥vj.

M. Sig.: A teaspoonful to a tablespoonful in half a glass of water every four or six hours after food.

Calcium phosphate, made soluble by combination with lactic acid in the form of the syrup of calcium lactophosphate, is a valuable reconstructive and tonic in feeble children with deficient development of bone, and also in

surgery, in treating ununited fracture. Exhaustion and anæmia, produced by long-continued suppuration or lactation, leucorrhœa, or chronic diarrhœa, are benefited by this preparation, which is also useful in caries. The compound syrup of the phosphates, or chemical food, has been found to be especially serviceable in these cases.

A class of preparations known as glycerophosphates of calcium, potassium, and sodium are praised by M. Albert Robin as of efficacy in the treatment of various depressed conditions of the nervous system. They may be given either by the mouth or subcutaneously, in the latter case 0.25 Gm. (or gr. iv) being an active dose. Dr. Robin has obtained excellent results from the use of these phosphates in convalescence from influenza, in neurasthenia, phosphaturia, phosphatic albuminuria, etc. In sciatica and Addison's disease he also witnessed notable improvement follow the use of the same preparations. The subcutaneous injection of glycerophosphates proved of decided benefit in an obstinate case of *tic douloureux*, which was accompanied by distressing paræsthesia. As the solutions become contaminated easily and are excellent culture-media, they should be preserved in sterilized bottles, large enough to hold only one injection, or the solution should be made immediately before using.

The hypophosphites have been largely used and highly extolled by Dr. Churchill in the treatment of pulmonary consumption, especially the alkaline hypophosphites, which should be perfectly pure, like those of Dr. R. W. Gardner, of New York. The object of treatment being to obtain calcareous degeneration of the tubercles, calcium hypophosphite may be administered alone, having the advantage of being nearly tasteless; it may be given in doses of 0.32 to 1.30 Gm. (or gr. v-xx) in pill form, or with an equal quantity of milk- or cane- sugar. The following prescription, containing the hypophosphites, is suitable as a tonic, especially in chronic bronchitis:—

℞ Acidi phosphorici dil.	11|	c.cm. or f℥iij.
Syrup. pruni Virg.	7|5	c.cm. or f℥ij.
Syr. hypophosphitum comp. q. s. ad	150|	c.cm. or f℥v.

M. Sig.: A teaspoonful in water three or four times a day.

Caution.—As a subject of interest and possible importance, it should be mentioned that the hypophosphites should not be triturated in a mortar, as they are liable to explode. Dr. H. Gifford, of Syracuse, while triturating a mixture containing 3 parts of calcium hypophosphite, and 1 of sodium hypophosphite, made this discovery, the compound exploding like gunpowder, severely burning his face and destroying the sight of one of his eyes.

Phosphorus in substance or solution, on account of its great toxicity, is now rarely prescribed; the restorative effects being obtained by the use of the hypophosphites, and phosphates, and their preparations.

Dr. E. Q. Thornton recommended the substitution of the red, or amorphous, variety, made by heating vitreous phosphorus to 250° C. (482° F.) in the absence of air. Amorphous phosphorus is almost completely destitute of taste or odor, has no immediate caustic effect, and is claimed to be less toxic than white phosphorus; but in the form of matches has caused many deaths, and is known as the "servant girls' poison."

PHYSOSTIGMA (U. S. P.).—**Physostigma.**

PHYSOSTIGMATIS SEMINA (B. P.).—**Calabar Bean.**

Preparations.

Tinctura Physostigmatis (U. S. P.).—Tincture of Physostigma (10 per cent.). Dose, 1 to 2 c.cm. (or *m*xv-xxx).

Extractum Physostigmatis (U. S. P., B. P.).—Extract of Physostigma, Extract of Calabar Bean. Contains 2 per cent of alkaloids.) Dose, 0.01 to 0.03 Gm. (or gr. $^1/_6$-ss).

Physostigminæ Salicylas (U. S. P.).—Physostigmine Salicylate, Eserine Salicylate. Dose, 0.001 to 0.003 Gm. (or gr. $^1/_{64}$-$^1/_{20}$).

Physostigminæ Sulphas (U. S. P., B. P.).—Physostigmine Sulphate, Eserine Sulphate. Dose, 0.001 to 0.003 Gm. (or gr. $^1/_{60}$-$^1/_{20}$).

Lamellæ Physostigminæ (B. P.).—Discs of Physostigmine. Discs of gelatin with some glycerin, each weighing about 1.3 mg. (or gr. $^1/_{50}$) and containing 0.065 mg. (or gr. $^1/_{1000}$) of physostigmine sulphate. For use in ophthalmic practice.

Pharmacology.—"The dried, ripe seed of Physostigma venenosum" (Leguminosæ), yielding, when assayed by United States process, not less than 0.15 per cent. of ether-soluble alkaloids. It contains the alkaloids **Physostigmine** (also known as **Eserine**) and **Calabarine**, starchy matters, oils, etc. The salts of physostigmine vary in solubility; that with salicylic acid is soluble and permanent. Jobst and Hesse, in 1864, first isolated the active principle as an amorphous alkaloid, to which they gave the name of physostigmine. Subsequently a crystalline, alkaloidal principle was found in the seeds by Vée and Leven, who gave it the name of eserine; the former was tasteless, the latter has a bitter taste. Eserine dissolves sparingly in water; it is easily soluble in ether, alcohol, and chloroform. In physiological effects they are analogous, and they are now regarded as different forms of the same substance. Bihringer has recently discovered a crystalline alkaloid, soluble in alcohol and ether, similar to, but weaker than, physostigmine, which he proposes to call **Eseridine**. Another crystalline principle, **Eseramine**, appears to be devoid of physiological activity. A substance termed **Physosterin**, related to cholesterin, is also present in physostigma. The presence of physostigmine may be demonstrated by dissolving a small quantity in 1 or 2 drops of fuming nitric acid. A bright-yellow liquid, which is the result, darkens in shade when heated on a water-bath, and upon evaporation the color changes to green. The addition of a drop of strong nitric acid with heat produces a violet red, changing to a dark-green solution.

Physiological Action and Toxic Effects.—The ordeal bean of old Calabar is a powerful poison, producing extreme muscular debility, vomiting, slow and weak pulse; it causes death either by cardiac syncope or, in smaller quantity, by paralysis of the respiratory centre and suffocation. Atropine counteracts the respiratory depression, and strychnine stimulates the cord, and thus act as physiological antidotes. Applied to the surface of the body, no effect is observed, unless absorption occurs. When introduced into the eye, physostigmine causes contraction of the pupil, beginning in about fifteen minutes and lasting for about eight hours, attended by slight twitching of the lids, supra-orbital pain, dimness of vision, fall of intra-ocular tension, spasm of accommodation, and myopia. The pupil contraction is held to be due to paralysis of the peripheral vasomotor nerve-fibres, and to stimulation of the fibres of the third nerve supplying the iris. Contraction of the pupil may also be produced by the internal administration of the drug, but, as the

rule, this result does not follow. This fact, as Phillips remarks, may aid in distinguishing poisoning by physostigma from that of opium. The brain is not affected, but the spinal cord suffers great depression of both motor and reflex activity. The conductivity of the motor nerves is also reduced. The pulse and respiration become slower and fuller after small doses, the arterial tension being at first increased; but in larger amounts, as the system becomes more influenced by the toxic action of the drug, the pulse becomes feeble and irregular and the arterial tension falls. This is explained by the primary stimulation and subsequent exhaustion of the peripheral cardiac filaments of the vagi. The secretions are slightly increased by Calabar bean, and vomiting and retching are apt to occur. Peristaltic action as well as the intestinal fluids are increased, and diarrhœa is a usual physiological consequence. Physostigmine sulphate is said to excite the pregnant womb to contraction. The bladder and spleen also contract under the influence of physostigma. The active principle is largely excreted by the kidneys, and likewise by the saliva and bile, and has even been found in the gastric secretions after intravenous injection. Physostigma is promptly absorbed, and elimination takes place with corresponding rapidity. Even the prolonged use of eserine drops, as a rule, has not given rise to any inconvenience. Roubinovitsch has reported a case[1] of a man, 80 years of age, suffering with glaucoma, who for three years had instilled into each eye, twice daily, 2 drops of a $^1/_2$-per-cent. solution of sulphate of physostigmine. For eight or ten months peculiar symptoms had followed each instillation. Sometimes the patient became drowsy and passed into a state of sleep with dreaming; sometimes he remained awake, but seemed to lose a correct perception of his surroundings; occasionally attacks of vertigo occurred. The case was then investigated. Before instillation the rectal temperature was 97.7° F. and the pulse was 80 and regular. Ten minutes after the instillation of 4 drops of the solution (representing about 1 mg. of eserine) the temperature had risen $^9/_{25}$° and the pulse-rate had increased by 12 beats in the minute. Thirty-five minutes after instillation the temperature had fallen $^9/_{50}$°, the pulse had returned to 80, but the tension was increased. On auscultation, intermittent action of the heart was found. The patient was semiconscious and had intellectual and sensory troubles. He insisted that he was tied to the ground with his arms suspended in the air. At the same time tonic jerks manifested themselves in the limbs. Three-quarters of an hour after instillation he slept with quasistertorous breathing. He awoke after about an hour, still having delusions. He had arteriosclerosis and polyuria, and, it was thought, a slight degree of granular kidney. Possibly defective elimination by the kidneys was the cause of the production of toxic symptoms by such a small quantity of eserine. The antidotes are atropine and strychnine subcutaneously, also chloral hydrate and stimulants.

Therapy.—The salts of physostigmine are used by oculists to break up adhesions of the iris, diminish intra-ocular tension, and prevent the prolapse of the iris after wound or ulcer of the cornea. Physostigmine is serviceable in glaucoma; a solution of 0.13 Gm. to 4 c.cm. (or gr. ii-f3j) of distilled water, a drop being instilled into the eye every fifteen minutes, soon gives relief. In the prodromal stage of glaucoma it has a tendency to abort the attack. During the acute inflammatory period it relieves pain. The

[1] *Lancet*, March 17, 1900.

application of eserine, moreover, is useful as a preparation for the operation. In coal-miners' nystagmus, M. Romié finds that a collyrium containing about 0.10 Gm. (or gr. iss) of eserine sulphate to 30 c.cm. (or f℥j) of distilled water is of service in diminishing the oscillation of the eyeballs. One drop of the solution is instilled into the eye thrice daily, and strychnine sulphate is at the same time given by the mouth.

It is useful in photophobia, reducing the amount of light by contracting the pupil, and diminishing the blood-supply by emptying the blood-vessels. Eserine is also employed in neuralgia of the eyeball, and to counteract the excessive action of atropine. In ulceration or suppuration of the cornea and in strumous ophthalmia the local action of eserine is very beneficial.

As a myotic, we may prescribe a combination of:—

℞ Physostigminæ salicylatis	1	Gm. or gr. xv.
Pilocarpin. hydrobromidi	2	Gm. or gr. xxx.
Aq. destill.	90	c.cm. or f℥iij.—M.

Sig.: Instil a few drops in the eye, as directed.

Internally, physostigma is useful in constipation due to defective secretion and to insufficient peristalsis, combined with other remedies, such as belladonna.

℞ Ext. physostigmatis	.06	Gm. or gr. j.
Ext. Belladonnæ folior	.065	Gm. or gr. j.
Res. podophylli	.20	Gm. or gr. iij.
Ol. cajuputi	.24	c.cm. or *m*iv.

M. et ft. pil. no. xij.

Sig.: Take one or two at bed-time.

Bartholow used the following formula:—

℞ Tinct. physostigmatis,		
Tinct. nucis vomicæ,		
Tinct. belladonnæ folior.	aa 7.5	c.cm. or f3ij.

M. Sig.: Thirty drops in water morning and evening for constipation of bowels.

This combination is useful in treating the digestive disorders of women at the change of life, relieving headache, vertigo, and flatulence. This remedy is said to be useful in the treatment of dilatation of the stomach. In tetanus, physostigma gives excellent results, recovery following in more than half the cases. Care should be taken that the extract or other preparation used is of good quality, and it should be pushed until decided physiological effects are produced. Of the present assayed official extract (2 per cent. alkaloids), the dose to begin with would be 0.006 Gm. (or gr. $^1/_{10}$), by the stomach, repeated every two hours, and increased or reduced, according to effect. The hypodermic method is to be preferred. In strychnine poisoning, while the symptoms are modified, there has been no case of recovery from the use of physostigmine alone, but the bromides might be combined with it advantageously. In other nerve affections, chorea, and epilepsy, and in progressive paralysis, great improvement has been noted. Physostigma has been successfully used in infantile convulsions after the failure of chloroform. In convulsive disorders of individual muscles of the face (histrionic spasm, tic, twitching of orbicularis, etc.) good results follow its employment. Calabar bean has likewise proved beneficial in writers' camp. It has been used with success in the treatment of obstinate cases of hiccough.

Temporary improvement, or arrested progress, was observed by Ringer and Murrell in paraplegia supposed to be due to myelitis. The same authorities saw improvement follow administration of the drug in locomotor ataxia. Physostigma is also capable, at least, in some cases, of controlling the night-sweats of phthisis. Murrell gave 0.01 Gm. (or gr. $^1/_6$) of extract in pill two or three times during the night, or 0.001 Gm. (or gr. $^1/_{60}$) of a physostigmine salt, and found that not only was sweating suppressed for the time, but that in some instances it did not recur for three or four weeks.

Professor de Giovanni, of Turin, has employed physostigma with good results in cases of renal hæmorrhage. He combines it with ergotin, as:—

℞ Ext. physostigmatis..... 38 Gm. or gr. vj.
Ergotin. ..... 2 Gm. or gr. xxx.
Ext. gentian..... q. s.

M. et. ft. pil. no. xxx.

Sig.: One or two pills a day, increased every day by one until the desired effect is produced or the limit of tolerance is reached. The same combination has been found of service in the treatment of symptoms dependent upon atheroma of the arteries. If an assayed extract is used, the dose of physostigma should be not more than 0.006 Gm. (or gr. $^1/_{10}$) to begin with.

In some affections of the air-passages, bronchitis, congestion of the lungs, and pneumonia, physostigma may be used to lower the excitability of the vagus and the activity of the heart and respiration. On account of its tonic effect upon the muscular coat of the bronchi, this drug is occasionally serviceable in bronchial asthma and emphysema. The tincture of physostigma, when well made, is a good preparation, but, for hypodermic and ophthalmological purposes, physostigmine salicylate is preferable.

PHYTOLACCA (U. S. P.).—**Poke-root.**

Dose, 0.065 to 0.13 Gm. (or gr. i-ij); or, as an emetic, 2 Gm. (or gr. xxx).

Preparation.

Fluidextractum Phytolaccæ (U. S. P.).—Fluid Extract of Phytolacca-root. Dose, emetic, 1 c.cm. (or *m*xv); ordinary, 0.10 c.cm. (or *m*iss).

Pharmacology.—The dried root of Phytolacca decandra (Phytolaccaceæ only is official. The active principle has not been isolated; but the plant contains a resin and an alkaloidal principle, **Phytolaccine,** and **Phytolaccic acid**; also tannin, oil, starch, etc. The active constituent appears to be a glucoside resembling, or perhaps identical with, saponin.

Physiological Action.—The powdered root is irritating to the air-passages, and when inhaled causes pains in chest, back, and abdomen, with injection and irritation of the eyes, and occasionally vomiting and purging. Applied to the skin, it occasions an erythematous eruption and excoriations. Poke is emetic, cathartic, narcotic, and is claimed to be alterative. As it only acts slowly, and creates much nausea and depression, it should never be used as an emetic. It reduces the force of the pulse and frequency of the heart's action, and also the rate of respiration. It acts decidedly upon the nerve-centres, paralyzing the cord and medulla, death being produced by carbonic-acid poisoning from failure of respiration. As it is a remedy easily obtained and used by a class of "herb-doctors," it is not surprising that cases of fatal poisoning have occurred. The antidotes are the diffusible stimulants,—am-

monia, alcohol, and ether,—with hypodermic injections of digitalis and small doses of morphine and atropine, with artificial respiration and counter-irritation.

Therapy.—In follicular pharyngitis, tonsillitis, granular eyelids, mastitis, malignant disease, varicose veins and ulcers, and in a large variety of skin disorders—such as chronic eczema, sycosis, favus, and abscesses—various observers have reported good results from the external and internal use of poke-root. The following formulæ are recommended:—

℞ Pulveris Phytolaccæ	4	Gm. or 3j.
Camphoræ	65	Gm. or gr. x.
Extracti belladonnæ folior.	4	Gm. or 3j.
Ungt. zinci oxidi	31	Gm. or 3j.

M. For chronic ulcers, fissure and fistula, and mammary abscesses.

℞ Pulvis phytolaccæ	4	Gm. or 3j.
Ungt. resinæ comp.	31	Gm. or 3j.

M. Useful in boils and carbuncles.

The fluid extract, applied upon absorbent cotton, is useful in checking the formation of a bubo. The pain produced by burns is alleviated by the local application of phytolacca. The fluid extract is esteemed valuable in the treatment of syphilis, scrofula, rheumatism, and in chronic skin diseases. The tincture and the fluid extract have yielded good results in chronic rheumatism and rheumatic swelling of the joints. Phytolacca is highly esteemed by the laity as a remedy for acute mastitis, applied locally and taken internally. M. M. Griffith claims that this remedy has very decided power in diminishing obesity. A. A. DeLong, of Azalia, Indiana, reports the successful treatment of goitre in young women by tincture of phytolacca, five drops every three hours; combined with local painting with tincture of iodine, until the skin blisters. After a few days, when skin heals, the daily painting with odine is resumed.

PICROTOXINUM (B. P.).—**Picrotoxin.**

A neutral principle prepared from the seeds of Anamirta paniculata (Menispermaceæ), or Cocculus Indicus. (See **Cocculus**, U. S. P.)

Dose, 0.0006 to 0.0027 Gm. (or gr. $^1/_{100}$-$^1/_{25}$). Antidotes: atropine, chloral hydrate, diffusible stimulants.

PILOCARPUS (U. S. P.).—**Pilocarpus.** **JABORANDI FOLIA** (B. P.).

Dose, 0.65 to 4 Gm. (or gr. x-3j), in infusion.

Preparations.

Fluidextractum Pilocarpi (U. S. P.).—Fluid Extract of Pilocarpus. Dose, 1 to 2 c.cm. (or *m*xv-xxx).

Pilocarpinæ Hydrochloridum (U. S. P.).—Pilocarpine hydrochloride. Dose, 0.005 to 0.02 Gm. (or gr. $^1/_{12}$-$^1/_3$).

Pilocarpinæ Nitras (U. S. P., B. P.).—Pilocarpine Nitrate. Dose, 0.003 to 0.03 Gm. (or gr. $^1/_{20}$-$^1/_2$).

Extractum Jaborandi Liquidum (B. P.).—Liquid Extract of Jaborandi. Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Tinctura Jaborandi (B. P.).—Tincture of Jaborandi. Dose, 2 to 4 c.cm. (or f3ss-j).

Pharmacology.—"The dried leaflets of Pilocarpus Microphyllus and Pilocarpus Jaborandi (Rutaceæ), yielding, when assayed by United States process, not less than 0.5 per cent. of alkaloids." The British Pharmacopœia

recognizes only the second named species. The leaves should be fully grown. They contain an alkaloid, first isolated by Hardy, in 1874, known as **Pilocarpine** ($^1/_4$ to $^1/_2$ or 1 per cent.). N. A. D. Jowett, in 1900, found a basic substance isomeric with pilocarpine, and is hence described as **Isopilocarpine.** It is a liquid, and can be obtained from pilocarpine by the action of heat or alkalies. There is also present a small proportion of **Pilocarpene,** volatile oil, and probably a peculiar acid. The active principles are soluble in alcohol, but only imperfectly so in water.

Physiological Action. — In about fifteen minutes after jaborandi has been swallowed, the face flushes and perspiration occurs, with more or less salivation, the two being related to each other in such manner that if there is little action upon the skin there will be more discharge of secretion from the salivary glands, and when the skin acts freely the salivation will be less. The profuse sweating removes not only water, but other matters from the blood, as it has been found to carry off urea and certain excrementitious materials. Arterial tension is reduced and temperature falls 1° to 4°. The decrease is due to a diminished heat production, but may, in part, be caused by sweating.

The action upon the skin is attributed to vasomotor paralysis, and the sialagogic action to stimulation of the peripheral nerves of the glands. Jaborandi also increases the action of the heart and respiration, but in larger doses depresses them by its paralyzing action on the vagus. Contraction of the pupil, with impaired power of accommodation, has been observed to follow its use. The same result is produced by its topical application. Atropine and muscarine are antagonistic in their effects to jaborandi or pilocarpine.

Pilocarpine readily diffuses into the blood, and is eliminated chiefly by the skin and salivary glands. Most secreting glands are similarly affected, to a greater or less degree. The gastric and pancreatic fluids are decidedly augmented. A certain, though less powerful, stimulant effect is exerted upon the liver. The lacrymal, mammary, and bronchial mucous glands are also excited. It increases the discharge of urea by the kidneys, but not the urinary water. Small and repeated doses of pilocarpine, however, have a diuretic effect. It causes contractions of the uterus and may induce abortion; it also reduces the size of the spleen. Children are less susceptible than adults to the action of pilocarpine. Demme, of Berne, has observed that, under four years of age, the action of this substance is more decided upon the salivary glands than upon the skin.

Serious and even fatal consequences have occurred as a result of injection of medicinal doses of pilocarpine. After employment of 0.02 Gm. (or gr. $^1/_3$) a patient suffered from profuse diaphoresis, salivation, lacrymation, a discharge from the nose, sickness of the stomach, difficulty in breathing, and a sense of cardiac oppression. Internal and external stimulation caused the symptoms to disappear. Remy mentions a case in which the remedy induced a series of epileptic attacks. In another case the patient suddenly expired directly after an injection had been made. Such accidents should teach caution in the use of the remedy. Pilocarpine should not be used in the condition of status lymphaticus, or where there is danger of pulmonary œdema. Atropine is a physiological antidote to jaborandi.

Therapy.—It has been noticed by Prentiss that under the use of pilocarpine the color of the hair darkens. It may thus be combined with a stimulant application to the scalp:—

℞ Fluidextracti pilocarpi
Lin. saponis ..... aa 15| c.cm. or f℥ss.
Spiritus odorati ..... 60| c.cm. or f℥ij.

M. Sig.: To be applied to the scalp once daily, with friction, for alopecia and falling of the hair.

In cases where diaphoresis is desired in order to remove matters from the blood or reduce temperature, pilocarpus is a convenient agent. Da Costa used it in acute erysipelas, where it is so effective that it might almost be regarded as a specific. In diphtheria, also, it is serviceable, but the depressing effect upon the heart must be kept in mind. Pulmonary œdema, too, may follow the administration of this drug; so that, although it is capable of detaching false membrane, it is of doubtful value, demands vigilant watchfulness, and should only be administered to previously strong individuals. Similarly, in mumps or parotitis it often abruptly stops the course of the disease. In agalactia of nursing women, small doses of pilocarpine restore the secretion of milk. Where there is œdema or effusion, the fluid extract of jaborandi is very commonly employed, in moderate doses, to keep up the action of the skin and increase the elimination of urea. In diabetes insipidus, alternated with the fluid extract of ergot, it reduces the urinary flow very decidedly. In asthma, or hiccough, an hypodermic injection of pilocarpine is sometimes promptly curative. Pilocarpine given subcutaneously may be of service in controlling the convulsive attacks of hystero-epilepsy and maniacal excitement. It was employed with much advantage by Dr. Kernig in the *status epilepticus*. Dr. Ch. Féré, on the contrary, whose experience in nervous disorders is large, asserts that he has never witnessed benefit from the injection of pilocarpine in epilepsy, and that sometimes it even seems to bring on a paroxysm. Jaborandi has been advantageously employed in whooping-cough. In small doses it, or its alkaloid, is useful in chronic bronchitis and winter cough. In doses sufficient to excite free diaphoresis, this remedy has proved very efficacious in the congestive stage of pneumonia, rapidly ameliorating the local condition and reducing the fever. When atropine is administered to check night-sweats in phthisis, it may be combined with fluid extract of jaborandi, which, as pointed out by Da Costa, relieves the dryness of the throat caused by the atropine. Pilocarpine itself is by no means an inefficient remedy for this manifestation, and the hydrochloride may be given nightly in 0.003 Gm. (or gr. $^1/_{20}$) dose by the mouth, with, usually, a good effect both upon the sweats and the cough. Professor Ringer has cured several cases of unilateral sweating by the hypodermic injection of full doses of pilocarpine. In ptyalism, also, pilocarpine has been advantageously employed in the same manner. In amblyopia of tobacco and alcoholic origin, and in amaurosis, pilocarpine is frequently used with good effect, and also in many other lesions and disorders of the eyeball. A few drops of a solution of pilocarpine (0.13 Gm. to 30 c.cm., or gr. ii-f℥j) may be locally employed with advantage in rheumatic iritis. The subcutaneous use of this remedy is also of avail in the same disease. Dr. G. H. Burnham, of Toronto, reports a case in which this method was followed by very excellent results. There was no iritis, but the centre of each cornea was studded with infiltrations. The pupillary area was involved and vision was very imperfect. The infiltrations disappeared, vision gained greatly, and the general manifestations of chronic rheumatism were also improved. Internally, the alkaloid is sometimes beneficial in detachment of the retina, and decidedly so

in optic neuritis. Its action upon the pupil enables it to be used in place of physostigmine. Staderini[1] (*Annali di Ottalmologia*) advises pilocarpine nitrate, subcutaneously, in many inflammatory diseases of the eyes, especially in those that are the consequence of rheumatism, as episcleritis, iritis, and idiopathic optic neuritis. Pilocarpine nitrate thus given, he states, subdues inflammatory conditions of the iris and of the ciliary body which supervene when masses of the cortical substance of the lens remain in the anterior chamber after the operation of extraction of cataract. Pilocarpine, the same writer believes, promotes the absorption of non-organized opacities in the vitreous humor, especially when these opacities are the consequence of recent infiltration. Progressive myopia, he further adds, shows improvement of vision after pilocarpine injection. In glaucomatous conditions of children, when physostigmine does not agree with the patient, Drs. Saint-Germain and Valude advise a collyrium containing 0.29 Gm. (or gr. ivss) of pilocarpine to 9.25 c.cm. (or f℥iiss) of distilled water. M. Berger adds pilocarpine to solutions of cocaine for use in the eye in order to avoid difficulties of mydriasis and a disturbance of accommodation. His formula is:—

℞ Cocainæ hydrochloridi,
Pilocarpin. hydrochloridi ..... aa 1|30 Gm. or gr. xx.
Aq. destill. ..... 90| c.cm. or f℥ij.—M.

Dr. A. D. Macdonald records a case, believed to be one of labyrinthine deafness, in which decided improvement followed the subcutaneous injection of pilocarpine. Professor Politzer and others teach that the hypodermic injection every day of 0.002 Gm. (or gr. $^1/_{30}$) of pilocarpine will cure certain cases of inflammatory, syphilitic, and hæmorrhagic deposit within the labyrinth, especially when of recent occurrence. If, however, no improvement has taken place after the lapse of a fortnight, Politzer believes that no advantage will result from persistence in the use of the remedy. Pilocarpine is beneficial in acute suppuration of the middle ear, with perforation of the membrana tympani. It is seldom useful when the membrane remains intact and the cavity is occupied by hardened inflammatory products, though it has, in some instances, promoted their absorption. Pilocarpine is of service in dry sclerotic catarrhs of the middle ear. Politzer also employs pilocarpine locally in affections of the middle ear to which it is adapted, injecting from 6 to 8 drops of warm 2-per-cent. solution through a catheter into the Eustachian tube and tympanic cavity.

Dr. Suarez de Mendoza has, in three cases, relieved urgent dyspnœa from œdema of the glottis by hypodermic injections of pilocarpine.

The action of jaborandi upon the glands of the skin makes it useful in many cases of chronic skin disorder, especially of the dry character.

Klotz has recently reported very favorable results from the hypodermic injection of 1.20 to 1 c.cm. (or *m*x-xv) of a 1-per-cent. solution of pilocarpine hydrochloride in chronic eczema. The hard, dry, and fissured condition of the skin was remarkably improved. Dr. Poulet suggests that the same procedure may be of service in the treatment of elephantiasis arabum. In some instances, jaborandi given internally has alleviated urticaria. Small doses of jaborandi by the mouth, or of its alkaloid subcutaneously, have proved remedial in hyperidrosis and bromidrosis. Pruritus is not uncommonly re-

[1] "Pilocarpine in Ocular Therapeutics," by G. Staderini, *St. Louis Clinique*, Jan., 1891.

lieved by this agent. The itching of jaundice is amenable to the influence of pilocarpine. Dr. Robert M. Simon, of Birmingham, England, finds nothing so useful as pilocarpine hypodermically in the treatment of pruritus senilis. It affords marked relief to the itching and permits the patient to sleep.

Pilocarpus can be administered for the diseases just named as follows:—

℞ Fluidextracti pilocarpi ..... 15| c.cm. or f℥ss.
Spiritus ætheris nitrosi,
Spiritus juniperi ..... aa 60| c.cm. or f℥ij.
Syrup. limonis .....q. s. ad 180| c.cm. or f℥vj.
M. Sig.: From a half to a tablespoonful in water every two or three hours.

℞ Infus. pilocarpi,
Infus. digitalis ..... aa 60| c.cm. or f℥ij.
M. Sig.: Two teaspoonfuls every two or three hours.

By Wilkowski, the hypodermic injection of pilocarpine is regarded as almost a specific in catarrhal jaundice. He attributes, moreover, a diagnostic value to the procedure. If a treatment of ten to fifteen days produces no effect upon the jaundice, the presence of a malignant growth of the liver is to be suspected. For the relief of dry tongue, or aptyalism, J. P. Blackmans strongly recommends 0.0003 to 0.0006 Gm. (or gr. $^1/_{200}$-$^1/_{100}$) of pilocarpine, inclosed in gelatin and allowed to melt on the tongue, which should be previously moistened with a little water. A moderate flow of saliva is excited within twenty-four hours, and general diaphoresis is never produced.

The dryness of the mouth, often so troublesome in diabetes mellitus, is relieved by the following prescription:—

℞ Pilocarpin. nitrat. ..... |048 Gm. or gr. $^3/_4$.
Alcohol. (40°) ..... 6| c.cm. or *m*xc.
Aquæ dest. ..... 7|5 c.cm. or f℥ij.
M. Sig.: Five or six drops of this mixture, either pure or diluted with 2 c.cm. (or f℥ss) of water, are dropped upon the tongue several times a day.

Pilocarpine has been found useful in the exanthemata, in conditions of suppression or retrocession of the rash.

Pilocarpine may be used hypodermically for the same purposes as jaborandi by the stomach, and is less apt to be followed by nausea and vomiting. Two cg. (or gr. $^1/_3$) under the skin generally causes free diaphoresis, while 0.03 Gm. (or gr. ss) produces such an amount of sweating as to frequently lead to a dangerous degree of prostration. The first dose should not exceed, for an adult, 0.01 Gm. (or gr. $^1/_6$). This dose usually is well borne, even by subjects of heart disease. Pilocarpine is a good substitute for the Turkish and other sweating baths in the treatment of ascites and serous effusions generally, and of œdema. In insomnia, with excitement bordering on mania, the administration of pilocarpine hypodermically causes relaxation and lowers arterial tension. E. F. Willoughby[1] has found this highly useful in the first stage of influenza. Saunders, of St. Louis, praises it as an adjuvant to antitoxin in the treatment of diphtheria, and claims to have treated 300 cases without a death. Small doses are useful in croup.

Pilocarpine, subcutaneously, has been employed successfully in belladonna poisoning. McGowan relates a case (*London Lancet*) in which two

[1] *The Therapist*, London, 1898.

injections of 0.03 Gm. (or gr. ss) each were undoubtedly the means of saving the patient's life. The same procedure is recommended as beneficial in acute alcoholism.

It can likewise be used with good effect in the albuminuria of pregnancy. Dr. E. L. B. Godfrey has prescribed pilocarpine very advantageously in this disease as follows:—

℞ Pilocarpinæ hydrochloridi	13	Gm. or gr. ij.
Potassii bicarbonatis	12	Gm. or ʒiij.
Acidi benzoici	4	Gm. or ʒj.
Tinct. cardamomi	15	c.cm. or fʒss.
Aquæ q. s. ad	90	c.cm. or fʒiij.

M. Sig.: A teaspoonful in water every three hours.

Pilocarpine is, however, an inappropriate remedy in œdema dependent upon disease of the heart, and should never be employed if the heart-muscle be decidedly weak and its cavities dilated. In malarial or renal dropsy, on the contrary, this alkaloid is of signal efficacy. Dr. Louis Waldstein claims favorable results in cases of enlarged lymphatic glands and lupus, from the hypodermic injection of pilocarpine.

In chronic rheumatic disorders and some skin affections such diaphoretic treatment is serviceable. Muscular rheumatism and sciatica have also been ameliorated by the same method. In acute parenchymatous inflammation of the kidneys, pilocarpine is of the greatest service, increasing the urinary water and decreasing the albumin and blood. In acute scarlatinal nephritis pilocarpine is a valuable remedy, especially employed as follows:—

℞ Fluidextracti pilocarpi	15	c.cm. or fʒss.
Misturæ potassii citratis	60	c.cm. or fʒij.
Syrup. aurantii	45	c.cm. or fʒiss.

M. Sig.: A teaspoonful or two every three or four hours.

In uræmic accidents and puerperal eclampsia the hypodermic injection of pilocarpine is of marked benefit, but, according to Phillips, endangers the life of the fœtus. H. Mollière, of Lyons, has witnessed good results in nephritis from the application of an ointment containing from 0.065 to 0.10 Gm. (or gr. i-iss) of pilocarpine nitrate to 93 Gm. (or ʒiij) of soft petrolatum. A stronger preparation will cause an eruption. He has found it useful in all cases except when uræmia is present.

The fulgurant pains of locomotor ataxia may sometimes be relieved by subcutaneous injection of the alkaloid, and in septicæmia it has materially modified the symptoms, even when failing to prevent death. In some instances it has proved successful in hydrophobia. Professor Ringer found the hypodermic use of full doses of pilocarpine of decided efficacy in cases of unilateral sweating.

An hypodermic injection of pilocarpine may arrest an attack of hiccough, or of asthma, and should be given a trial in acute pulmonary œdema. A cold may be broken up by small doses of pilocarpine followed by quinine. A dose of pilocarpine will generally succeed in averting or cutting short a malarial chill.

PIMENTA (U. S. P., B. P.).—**Allspice, Pimento.**

Dose, 0.65 to 2.60 Gm. (or gr. x-xl).

Preparations.

Oleum Pimentæ (U. S. P., B. P.).—Oil of Pimenta. Dose, 0.03 to 0.32 c.cm. (or *m*ss-v).

Aqua Pimentæ (B. P.).—Pimento-water (pimento, 250 Gm., or ℥viij; water, 10 litres, or Oxxj; distill one-half).

Pharmacology.—"The dried nearly ripe fruit of Pimenta officinalis" (Myrtaceæ), of tropical America, is an aromatic stimulant, mainly used as a spice to promote appetite and digestion. It contains a volatile oil, which is official (3 to 4 per cent.), some fixed oil, resin tannin, gum, etc. A fluid extract is also made, but is not official (dose, 0.50 to 2.50 c.cm., or *m*viii-xl), and an aromatic water.

Physiological Action and Therapy. — Allspice is a pungent, aromatic stimulant, acting as a carminative, and stimulating the secretions of the mouth and stomach. It may be used to disguise the taste of unpalatable drugs, and is one of the ingredients of spice plasters. The oil can be added to pill-masses to prevent the griping of purgatives.

PIMPINELLA.—Pimpernel. The root of Pimpinella saxifraga (Umbelliferæ), growing in Europe, contains a golden-yellow volatile oil with an odor resembling that of parsley-seed, some acrid resin, and benzoic acid.

Physiological Action.—It exerts decided effects over mucous membranes, and is diuretic and expectorant.

Therapy. — Used in catarrh of various parts of the body, including gastric catarrh and bronchorrhœa. It is best given as fluid extract.

PINI OLEUM (B. P.).—**Oil of Pine.** (See **Oleum Pini.**)

PINUS STROBUS.—White Pine. The inner bark of Pinus strobus (Pinaceæ). Of uncertain physiological action, but thought to be expectorant. Is an ingredient in syrupus pini strobis compositus (N. F.), used as a cough remedy.

PINUS CANADENSIS.—Hemlock Spruce. The dried bark of the Tsuga Canadensis (Pinaceæ) contains a considerable quantity of tannin, with a little volatile oil, and is largely used in the tanning industry.

Therapy.—In the form of a dilute, alcoholic fluid extract this is a convenient agent to be employed where the effects of tannin are desired. It is used principally as a local astringent in pharyngitis, tonsillitis, uterine catarrh, and hæmorrhoids, applied in full strength; or it may be used diluted as a wash in leucorrhœa or gleet. This drug may be employed in diarrhœa of adults, although in such cases the prescription had better be written at once for tannic acid in the desired quantity.

Caution.—A white extract of Pinus Canadensis of proprietary character contains zinc sulphate, and should therefore not be taken internally, but used only as an external application or wash. It rapidly relieves the pain of a burn, when applied in full strength, according to Dr. W. C. Wile.

PIPER (U. S. P.).—**Pepper.**

PIPER NIGRUM (B. P.).—**Black Pepper.**
Dose, 0.13 to 1 Gm. (or gr. ii-xv).

Preparations.

Oleoresina Piperis (U. S. P.).—Oleoresin of Pepper. Dose, 0.015 to 0.06 c.cm. (or *m* ¼-j).

Piperinum (U. S. P.).—Piperin (a neutral principle obtained from pepper, and occurring also in other plants of the same natural order). Dose, 0.03 to 0.65 Gm. (or gr. ss-x).

Confectio Piperis (B. P.).—Confection of Pepper (black pepper, 40; caraway-fruit, 60; and clarified honey, 300 Gm.). Dose, 4 to 8 Gm. (or 3i-ij).

Pharmacology.—Pepper is the dried "unripe fruit of Piper nigrum" (Piperaceæ) of India and neighboring islands. The berries are small, pungent, and spicy to the taste, and of aromatic odor; they contain **Piperine,** volatile oil, pungent resin, fatty matter, etc. The oleoresin, extracted by ether, contains the volatile oil and acrid resin, with a little piperine. The latter is in pale-yellow prisms, and may be contaminated with some of the volatile oil.

Physiological Action.—Pepper is an irritant externally and internally. Owing to its pleasant pungency it is largely used as a condiment at the table. It is decidedly stimulating to the digestive organs and to the circulation, and also, but to a less degree, to the kidneys, as it passes out of the body by the urine. Pepper likewise promotes the action of the skin. If taken in excessive quantities its local action is sufficiently powerful to excite inflammation of the gastro-intestinal mucous membrane, and cases are on record in which pepper has produced delirium, rigors, and convulsions.

Therapy.—In flatulent dyspepsia and feeble digestion, pepper may be advantageously taken with the food. It is an ingredient of the Asiatic pill, which has been used in hæmorrhoids, with decided benefit:—

℞ Arseni troxidi ..... 20 Gm. or gr. iij.
Piperis ..... 15|5 Gm. or ʒss.
M. et ft. pil. no. lx.
Sig.: A pill after meals for indigestion and hæmorrhoids.

Lozenges containing pepper have also been successfully employed for the relief of hæmorrhoids, ulcers of the rectum, and fissures of the anus. Dr. Whitla suggests that cubeb be added, and the balsam of copaiba be substituted for the inert honey which enters into the formula of the British confection of pepper. He also recommends the following preparation in atonic condition of the lower bowel:—

℞ Pulv. piperis nigri.
Pulv. carui,
Pulv. cubebæ ..... aa 15|5 Gm. or ʒss.
Mel despumatæ ..... q. s.
Ft. electuarium.
Sig.: A teaspoonful three times a day.

Pepper is largely used in domestic medicine as a gargle for sore throat, and is not without effect in relaxed uvula. It has also been made into an ointment, and applied with success to tinea capitis. Piperin has some antiperiodic powers, and is a good addition to a pill for chronic malaria. In neuralgia it may be locally applied as a counter-irritant.

PIPERAZIN.—Piperazin, a synthetical compound [$(C_2H_4NH)_2$ or $C_4H_{10}N_2$], which may be prepared by several patented processes. Its chemical title is diethylenediamine. It occurs in the form of colorless, acicular crystals, of a pleasant taste and freely soluble in water. It is an admirable solvent for uric acid, with which it forms a neutral and very soluble salt.

Experiments in the laboratory demonstrate the solvent action of a 1-per-cent. solution upon calculi, not only those composed of uric acid, but also those containing calcium phosphate, ammonium urate, etc. Piperazin urate is said to be seven times more soluble in water than lithium urate, and piperazin will render soluble twelve times as much uric acid as lithium carbonate. With hydrochloric acid it forms an easily soluble and crystallizable salt. Piperazin is a deliquescent body, and should not, therefore, be prescribed in the form of a pill or powder, but in solution consisting of 20 parts of alcohol and 80 of water. The dose is 1 to 2 Gm. (or gr. xv-xxx) a day, in several doses, diluted with plain or carbonated water. It combines with cinchona, forming piperazine cinchonate (Sidonal), and also with tartaric acid (see Lysidine).

Physiological Action.—Piperazin is non-toxic and unirritant to mucous membranes with which it comes in contact. It is without effect upon digestion, circulation, or respiration. This substance passes through the system unchanged, and speedily appears in the urine in a state of combination with uric acid. Piperazin has been recognized in the urine two hours after ingestion. Piperazin has no effect upon the acid reaction of that fluid, and does not increase its quantity. Wittback, however, in studying the urine of patients taking piperazin, has observed cases in which its quantity was largely increased. The specific gravity was always diminished. The acidity of the urine was decreased. In some experiments upon themselves, Drs. Heubach and Kuh, after taking 2.40 Gm. (or gr. xxxvij) during the day, experienced severe headache on the following morning, and upon one occasion vomiting occurred. Tremors, hallucinations, and clonic spasms have been observed by Stewart as a result of full doses of piperazin.

Therapy. — In accordance with its chemical properties, piperazin has been found an efficient remedy in lithæmia and other manifestations of the uric-acid diathesis. Renal and vesical calculi, due to the deposit of uric acid, have been extruded under the influence of this remedy. Piperazin is likewise serviceable by dissolving the organic matter contained in the stones. Calculi in the bladder may also be attacked by the injection of a solution of piperazin into the viscus. Dr. F. Schmey has obtained good results in chronic cystitis by the administration of piperazin in sufficient doses to saturate the urine. A solution in alcohol and water has been applied locally to gouty joints and swellings, and aids the effect of the internal administration. A combination of piperazin and phenocoll is warmly recommended for the relief of gout. Piperazin has also been advantageously associated with phenacetin in the treatment of gout.

Dr. Eccles has employed piperazin with advantage in chronic rheumatic arthritis, and Dr. Heubach relieved lumbago by the hypodermic injection of a 2-per-cent. solution, in quantity equal to 0.20 Gm. (or gr. iij) a day. The injections gave rise to some pain, but did not cause abscesses or unpleasant after-effects. Dr. Disbrow, of Newark, N. J., saw alleviation of paræsthesia from the administration of this agent. Piperazin has proved of service in renal colic and hæmorrhage from the urinary passages. Piperazin was employed by Gruber in a case of diabetes, 0.32 Gm. (or gr. v) doses being given thrice daily, the diet being at the same time properly restricted. The proportion of sugar excreted was reduced and the general condition of the patient improved. Other writers have also observed subjective and objective improvement follow the use of piperazin in diabetes.

Piperazin may be acceptably given in the form of an aërated water, 1 Gm. (or gr. xv) being dissolved in a quart, and the entire quantity taken during the day. It is also prescribed dissolved in distilled water and flavored with a little syrup of orange or other agreeable vehicle. Piperazin is incompatible with alkaloids and salts of iron, with tannic acid, alum, preparations of cinchona, Donovan's solution, potassium permanganate, sodium salicylate, acetanilid, and phenacetin.

Lysidin.—Ladenburg has recently directed attention to this substance, which is ethylene-ethenyl-diamin, a reddish-white, crystalline substance of peculiar taste, suggesting the odor of mice, which is so hygroscopic that for convenience in dispensing it is supplied only in 50-per-cent. solution. It is strongly alkaline, and is said to have five times the power of piperazin as a uric-acid solvent. Professor Ladenburg uses it in gout, in daily doses of 1 to 5 Gm. (or gr. xv-lxxv) in aërated water. It is claimed to be entirely free from toxic effects or disagreeable consequences.

Lycetol.—A substance known commercially as lycetol, which chemically is di-methyl-piperazin tartrate, is thought to be superior to uncombined piperazin, as the tartaric acid is claimed to split up into carbonic acid, alkalinizing the blood and dissolving uric acid. Lycetol has a diuretic effect and may be used in gout in the daily dose of 1 to 2 Gm. (or gr. xv-xxx). The addition of sugar to a solution of lycetol produces an acid drink similar to lemonade.

PISCIDIA ERYTHRINA.—Jamaica Dogwood. The bark of the root of Piscidia erythrina (Leguminosæ), a tree of the West Indies, growing to the height of twenty feet, has a heavy, narcotic odor, recalling that of opium, and has a bitterish, acrid taste. It contains **Piscidin,** a neutral, crystallizable, resinoid substance, insoluble in water, but soluble in alcohol, besides other resinous substances, oil, tannin, etc., but it has not yet been determined to which of these the physiological effects are attributable. Some useful preparations of this agent are: Extractum piscidiæ (extract of Jamaica dogwood); dose, 0.13 to 0.65 Gm. (or gr. ii-x). Pulvis extracti piscidiæ (powdered extract of Jamaica dogwood); dose, 0.13 to 0.65 Gm. (or gr. ii-x). Pilula piscidiæ (made from the extract), containing 0.13 Gm. (or gr. ij). Fluidextractum piscidiæ (fluid extract of Jamaica dogwood); dose, 2 to 7.50 c.cm. (or f℥ss-ij).

Physiological Action. — According to the experiments of Prof. Isaac Ott, Jamaica dogwood is narcotic to frogs, animals, and men. It enhances the secretion of the skin, reduces the frequency of the pulse, raises arterial tension by stimulating the vasomotor centre, the increase being soon followed by a fall due to a weakening of the heart. It causes a tetanoid state by a stimulant action upon the spinal cord. Jamaica dogwood likewise causes dilatation of the pupil, followed by contraction as asphyxia develops. It causes death by either heart-failure or, what is more frequent, by arresting respiration. Pitcher has observed several cases in which alarming symptoms supervened from 0.50 c.cm. (or *m*viij) doses every three hours. Jamaica dogwood, used medicinally in suitable doses, will not diminish the appetite or cause constipation. It is seldom followed by nausea, headache, or other unpleasant effects.

Therapy. — Jamaica dogwood, in hæmorrhoids, has been successfully used locally in conjunction with lead acetate. A cloth saturated with the

fluid extract has been found efficient in superficial burns and scalds. Flagg states that the fluid extract of Jamaica dogwood has been found to possess decided value as a local and systemic analgesic. In general practice this combination of effect is frequently desirable, and in dental practice it will be recognized as especially valuable in treatment of periodontitis, alveolar abscess, pulp irritation, and other painful conditions within the oral cavity, as topical applications, with directions to swallow the saliva, promptly induce relief. Flagg also recommends 0.30 to 0.60 c.cm. (or *m*v-x) of the fluid extract given at the same time, in the diseases named, every hour or so as required.

Internally, Jamaica dogwood allays pain, relaxes spasm, quiets reflex excitability, and promotes sleep. It is consequently well adapted to act as a substitute for opium, especially when, as is not infrequently the case, the latter drug is not well borne. In the various forms of neuralgia, including sciatica, Jamaica dogwood has proved of value. Gastro-enteralgia, consequent to typhoid fever, has been also notably relieved by it. In the lancinating pains of locomotor ataxia it has, however, proved inefficient. Dr. Liégeois has found this drug of service in allaying the continuous cardiac pain due to arteriosclerosis. When angina pectoris has developed he considers Jamaica dogwood to possess a certain prophylactic power by virtue of its sedative effect upon the circulation. As synergistic drugs he sometimes combines aconite and veratrum viride:—

℞ Tinct. piscidiæ,
Tinct. veratri ..... aa 15| c.cm. or i℥ss.
Tinct. aconit. ..... 9|25 c.cm. or f℥iiss.

Of the above mixture he gives, during one-third of the month, 1 c.cm. (or *m*xv) three times a day, placing his patient, for the remainder of the month, upon sodium iodide.

In pelvic neuralgia, the pain produced by fibroma of the uterus, and in dysmenorrhœa piscidia has been found of much service. This remedy is likewise able to quell the pains of false labor and of threatened abortion, in which, and in dysmenorrhœa, it is well combined with viburnum prunifolium, as:—

Fluidext. piscidiæ
Fluidext. viburni prunifolii
Syrupi aurantii ..... aa 30| c.cm. or f℥j.
M. Sig.: A teaspoonful, to be repeated every hour or two.

The pain due to a fractured bone may be assuaged by administrations of this agent, which is also beneficial in acute or chronic rheumatism. The pains of inflammation may likewise be ameliorated by Jamaica dogwood. In panophthalmitis, iritis, iridocyclitis, and in acute abscess of the auditory meatus it is also capable of relieving the suffering. The pain of carcinoma has been assuaged by this remedy, which may here not infrequently replace opium with advantage. On account of its antispasmodic virtues, it is of considerable service in alleviating the paroxysms of asthma and whooping-cough, and cases of chorea have been reported in which it proved of benefit.

It is also beneficial to coughs of reflex origin, of bronchitis, and of pulmonary tuberculosis. Hysterical convulsions have yielded to the influence of this drug. Piscidia quiets restlessness and delirium, and induces sleep in delirium tremens and mania a potu, and has been employed with

gratifying success in the insomnia of insane patients. In insomnia, however caused, this agent fulfills an excellent service. Uterine colic and cholera morbus likewise prove amenable to its action.

PIX BURGUNDICA (B. P.).—**Burgundy Pitch.**

Preparations.

Emplastrum Picis Burgundicæ.—Burgundy-Pitch Plaster.

Emplastrum Picis Cantharidatum.—Cantharidal-Pitch Plaster (cerate of cantharides, 8; Burgundy pitch, 92 parts).

Emplastrum Picis (B. P.).—Pitch Plaster.

Pharmacology and Therapy.—Burgundy pitch is "the prepared, resinous exudation of Abies excelsa" (Coniferæ); the resinous exudation obtained from the stem of Picea excelsa (B. P.): a tree of southern Europe. It is a resin with traces of volatile oil. It has some balsamic properties, and is slightly irritating to the skin. In exceptional instances its local action is severe, and it gives rise to vesicles and pustules, or even produces ulceration. The official plasters are mild counter-irritants. The warming plaster is useful in chronic rheumatic swellings and in affections of the chest. Burgundy pitch has been thought to have some special action upon the rectum, and for this reason has been given in hæmorrhoids, made into a pill with tar. Burgundy pitch also enters into emplastrum galbanum, iron plaster, and the United States Pharmacopœia opium plaster.

Dr. L. M. Houser observed a case of intoxication in a child, 8 years of age, who had eaten a small quantity of the exudation from the tree. The symptoms were extremely dilated pupils, mental excitement with hallucinations, and frequent micturition. The patient recovered, but the pupils remained somewhat dilated for several days.

PIX CANADENSIS.—Canada or **Hemlock Pitch.**

Pharmacology.—The prepared resinous exudation of Abies Canadensis (Coniferæ) contains resin and a trace of volatile oil. The uses are similar to Pix Burgundica.

PIX LIQUIDA (U. S. P., B. P.).—**Tar.**

Preparations.

Syrupus Picis Liquidæ (U. S. P.).—Syrup of Tar. Dose, 4 to 7.5 c.cm. (or f3i-ij).

Oleum Picis Liquidæ (U. S. P.).—Oil of Tar. A volatile, oily liquid distilled from wood tar.

Unguentum Picis Liquidæ (U. S. P., B. P.).—Tar Ointment (U. S. P. contains 50 per cent. of tar).

Liquor Picis Carbonis (B. P.).—Solution of Coal-tar (prepared coal-tar, 200 Gm.; quillaia-bark, 100 Gm.; percolated with alcohol, 90 per cent., q. s. 1000 c.cm.).

Pix Carbonis Præparata (B. P.).—Prepared Coal-tar (prepared by placing coal-tar in a shallow dish and maintaining it at a temperature of 120° F. for one hour).

Pharmacology.—Tar is a liquid, empyreumatic oleoresin, "a product obtained by destructive distillation from the wood of Pinus palustris and other species of pinus" (Pinaceæ) of Europe and America; that coming from North Carolina and Sweden is the best. The British Pharmacopœia describes tar as "a bituminous liquid, obtained from the wood of Pinus sylvestris, and other species of Pinus by destructive distillation; known in commerce as Stockholm tar." It should be free from mechanical impurities. It

contains oil of turpentine, pyrocatechin, acetic acid, acetone, methylic acid, xylol, creosote, phenol, etc., and is blackened by wood-smoke. Tar is soluble in less than its own bulk of alcohol or chloroform, is slightly soluble in olive-oil or oil of turpentine. By distillation it yields an acid liquor called pyroligneous acid, and an empyreumatic oil, called oil of tar, which is official. The oil has but little color when fresh. It deepens with age to a dark-reddish brown. It is a volatile fluid, of acid reaction, has the odor and taste of tar, and is soluble in alcohol. What is left behind is pix navalis, or pitch, which is a black solid, presenting a shining, fractured surface, melts in boiling water, and consists of resin with various empyreumatic resinous products, which have collectively received the name of **Pyretin.** The creosote of tar is of special interest on account of its antiseptic and preservative properties, from whence it derived its name. The creosote of beech-wood is preferred in medicine.

Physiological Action.—Tar is an irritant, and is liable to produce a papular eruption upon the skin if applied too freely; its use internally is also sometimes provocative of erythema, vesicles, or papules, accompanied by severe itching. It is absorbed readily, so that, when a large surface is exposed to its action, feverish symptoms, blackish urine, and symptoms of carbolic-acid poisoning may ensue. The stools become blackish, and, as well as the urine, possess the odor of tar. Epigastric pain, vomiting, severe headache, or a sense of oppression in the head may also occur. Tar has an astringent effect upon mucous membranes. It has decided antiseptic power. When tar is taken internally, small doses exert a stimulating effect upon the circulation and secretory apparatus. Large, or too-long-continued, doses destroy appetite and impair digestion, depress the action of the heart, and cause nervous exhaustion. Taylor instances a fatal case caused by the accidental ingestion of the oil of tar. Large quantities of tar itself have been taken without fatal consequences.

Therapy. — Tar is a good application to scaly skin diseases, such as psoriasis, but the official ointment is liable to cause irritation and should be diluted when used:—

℞ Ungt. picis liquid..... 8| Gm. or ℥ij.
Ungt. zinci oxidi..... 23| Gm. or ℥vj.
M. For the relief of itching in chronic eczema.

Tar ointment has been used with success in scabies and tinea. It is necessary, always, to be careful in applying tar, as it may excite dermatitis or an acne-like eruption which Hebra called "tar-acne." Tar ointment is of value in prurigo, and is sometimes capable of lessening this notoriously rebellious affection. Pruritus ani is often allayed by a weakened tar ointment. In some patients there is an intolerance of tar and even the smallest quantity will excite irritation and cause a papular, eczematous eruption.

In the treatment of hæmorrhoids, Dr. Lacruz recommends a preparation composed of:—

℞ Picis liquidæ..... 3| c.cm. or *m*xlv.
Ext. belladonn. folior..... 3| Gm. or gr. xlv.
Glycerit. amyli..... 30| c.cm. or f℥j.
M. Sig.: Apply morning and night.

Tar ointment, either in full strength or modified, is serviceable in lichen, comedo, sycosis, pemphigus, lupus erythematosus and vulgaris. In

order to prepare an unirritating tar ointment, Stern advised that the tar be previously allowed to stand for several weeks in a warm place. It will be found that it separates into two layers, the upper of which is thin and syrupy, while the lower is thick and often mixed with small solid particles. The upper layer is destitute of irritant properties. An alkaline tar-water, made by adding tar, 7.5 c.cm. (or f℥ij); caustic potash, 4 Gm. (or ℥j); to water, 150 c.cm. (or f℥v); is a useful agent in the treatment of chronic eczema.

Pix Navalis, or pitch, is used externally in plasters. It is entirely different from the residue of coal-tar, or "gas-pitch."

A tar-water (made by mixing 1 part of tar with 4 of water) was formerly official. It is a sherry-colored, slightly-acid liquid, having a strong odor of tar. It may be used with an atomizer or vaporized by heat in chronic catarrhal disorders of the air-passages. Ringer and Murrell have demonstrated the usefulness of tar in winter cough, and have ascertained that it materially lessens the tendency to taking cold. Dr. Phillips finds it of service in chronic pulmonary tuberculosis; it improves appetite and digestion, checks diarrhœa, and quiets cough. The tar-water spray is beneficial in pharyngitis and laryngitis. It is also an efficient antiseptic application to unhealthy wounds or ulcers. Tar is likewise taken internally for the same class of diseases for which terebinthinate preparations are usually prescribed. Pills containing 0.065 or 0.13 Gm. (or gr. i-ij) are useful in winter cough and other bronchial disorders. In many chronic skin disorders the internal administration of tar is a valuable adjunct to local treatment. McCall Anderson speaks favorably of the action of small doses of tar, taken internally, in both psoriasis and chronic eczema.

In ozæna, Moire recommends a combination of:—

℞ Pulv. camphor.	6	Gm. or ℥iss.
Tr. iodi.	11	c.cm. or f℥iij.
Potass. iodid.	2	Gm. or ℥ss.
Picis liquid.	13	c.cm. or f℥iiiss.
Alcohol. (90°)	90	c.cm. or f℥iij.
Aquæ	180	c.cm. or f℥vj.—M.

The mixture is placed upon a water-bath and the fumes are inhaled for two or three minutes. The nasal chambers are then cleansed with a spray of 1-per-cent. carbolized alkaline water.

Lysol, a new tar combination, is derived, according to Gerlach, from tar-oils by boiling with alkalies and fats. It possesses the consistency of soft, or potash, soap, is of a brownish color, contains 50 per cent. of cresols, and is readily soluble in water.

Lysol is said by Gerlach to be a good disinfectant and antiseptic. He employs a $^1/_2$- to 1-per-cent. solution, in surgical operations. It is more easy of application than soap and disinfectant fluids, and removes dirt, fatty matter, etc., from the skin and instruments. Lysol has the advantage of being odorless and comparatively innocuous. Michelson has found it useful as a wash in major and minor gynæcological operations. In laparotomies he made use of a 1-per-cent. solution for all purposes except irrigation of the peritoneal cavity, for which a 0.3-per-cent. solution is sufficiently strong. The weaker solution is also of service in obstetrical practice. A gauze saturated in a 5-per-cent. solution removed the odor of cancer of the cervix. This agent promotes the granulation of wounds. Catgut immersed for two hours in a 5-per-cent. solution became as hard and resistant as if it had been

treated by alcohol or oil of juniper. Lysol is likewise well adapted for use as a disinfectant in the sick-room or hospital ward, schools, etc., and wherever such an agent is required.

Lysol is capable of causing toxic manifestations, as in a case reported by Dr. Reich. The application of pure lysol to a large part of the body of a young man was followed by loss of consciousness and convulsions, violent inflammation of the skin, and the appearance for two days of albumin in the urine. On the other hand, Dr. Potjan records a case in which a teaspoonful of lysol was swallowed by mistake without evil consequences.

Lysol has been used with satisfactory results in some cases of lupus. Lysol has likewise been successfully employed in gonorrhœa of the male by Dr. V. Carvollo in the form of a 1-per-cent. solution injected into the urethra three times a day to begin with, and less frequently as the discharge was arrested. Professor Parvin stated that, in cystitis of the female, injections of a $^1/_2$-per-cent. lysol solution gave good results. Dr. Haug recommends irrigation with a 1-per-cent. solution in the treatment of otorrhœa. A 1-per-cent. solution in ozæna, a 2-per-cent. solution in eczema, and a $^1/_2$-per-cent. solution in tonsillitis have been used with benefit. The use of about a pint of a 1-per-cent. solution as an enema three times daily has been found of service in dysentery. Lysol has been administered with advantage internally in dyspepsia in doses from 0.048 to 0.50 Gm. (or gr. $^3/_4$-viij) after each meal. The taste may be disguised by essence of peppermint.

Pixol.—Another disinfectant prepared from tar is termed **pixol.** It was devised by Dr. Raptchevski, and has the special merit of being exceedingly cheap. Pixol is made by dissolving a pound of green soap in 3 pounds of tar and slowly adding a solution of a little more than 108 Gm. (or ℥iiiss) of either potash or soda dissolved in 3 pounds of water. The result is a syrupy fluid which, in 5-per-cent. dilution, is used for disinfecting linen and washing the hands. A 10-per-cent. solution is an efficient disinfectant of dejecta. A solution of the latter strength is said to be fatal to the microorganisms of suppuration, anthrax, typhoid fever, and cholera.

PLANTAGO.—Plantain. The leaves of plantain (Plantago major and lanceolata; natural order, Plantaginaceæ), an indigenous herb, are used popularly as a vulnerary, the fresh leaves being made into a paste and applied to wounds. In rhus poisoning, burns, scalds, bruises, and even erysipelas, it is said to be efficient. An infusion may be administered internally, or a fluid extract may be given in doses of 0.30 to 4 c.cm. (or *m*v-f℥j), but it has no very marked physiological effects.

PLATINUM.—Platinum. No salts of platinum are official.

PLUMBUM.—Lead.

Salts and Preparations.

Unguentum Diachylon (U. S. P.).—Diachylon Ointment.

Ceratum Plumbi Subacetatis (U. S. P.).—Goulard's Cerate (20 of Goulard's extract to 80 parts of camphor cerate).

Plumbi Nitras (U. S. P.).—Lead Nitrate. Used as a disinfectant. Ledoyen's solution is a solution in water (12 $^1/_2$ per cent.).

Plumbi Acetas (U. S. P., B. P.).—Acetate of Lead (Sugar of Lead). Dose, 0.065 to 0.32 Gm. (or gr. i-v).

Plumbi Iodidum (U. S. P., B. P.).—Lead Iodide. Dose, 0.005 to 0.015 Gm. (or gr. $^1/_{12}$-$^1/_4$).

Plumbi Oxidum (U. S. P., B. P.).—Lead Oxide, Litharge.

Emplastrum Adhesivum (U. S. P.).—Adhesive Plaster (rubber, 20 Gm.; petrolatum, 20 Gm.; lead plaster 960 Gm.).

Emplastrum Plumbi (U. S. P., B. P.).—Lead Plaster, Diachylon Plaster.

Liquor Plumbi Subacetatis (U. S. P.), Liquor Plumbi Subacetatis Fortis (B. P.).—Solution of Lead Subacetate, Goulard's Extract (contains lead acetate, 17 Gm.; lead oxide, 10 Gm.; distilled water, q. s. 100 Gm.).

Liquor Plumbi Subacetatis Dilutus (U. S. P., B. P.).—Diluted Solution (strong solution of lead subacetate, 3 per cent.). (The B. P. formula is about one-half the strength of the U. S. P.)

Plumbi Carbonas (B. P.).—Lead Carbonate. White Lead.

Unguentum Plumbi Carbonatis (B. P.).—Ointment of lead Carbonate (10 per cent).

Unguentum Plumbi Iodidi (B. P.).—Ointment of Lead Iodide (10 per cent.).

Unguentum Plumbi Acetatis (B. P.).—Lead-Acetate Ointment (4 per cent.).

Unguentum Glycerini Plumbi Subacetatis (B. P.).—Lead-Subacetate Ointment (16 per cent.).

Glycerinum Plumbi Subacetatis (B. P.).—Glycerin of Lead Subacetate (nearly 15 per cent. of lead).

Emplastrum Plumbi Iodidi (B. P.).—Lead-Iodide Plaster (contains lead iodide, 50; resin, 50; lead plaster, 400).

Suppositoria Plumbi Composita (B. P.).—Compound Lead Suppositories (each contains 0.20 Gm., or gr. iij, of lead acetate and 0.065 Gm., or gr. j, of opium in powder).

Pilula Plumbi cum Opio (B. P.).—Pill of Lead with Opium (contains 12 1/2 per cent. of opium and 75 per cent. of lead acetate). Dose, 0.13 to 0.25 Gm. (or gr. ii-iv).

Pharmacology.—Metallic lead is readily affected by the oxygen of the air or by carbonic acid of water, and, although not poisonous itself, its salts are all deleterious, even in small amounts. Lead is therefore not a suitable lining for a reservoir for drinking-water, and lead pipes should not be used for conveying water for household purposes, unless lined with tin. White lead and red lead are largely used both by painters and plumbers, who are liable to be affected, owing to absorption through the skin. Lead chromate is a yellow pigment used as a protective applied to the covers of hams, and is also sometimes fraudulently used by bakers to color cake, in order to make up for deficiency of eggs. Lead acetate is astringent and sweetish, and has been swallowed by mistake for other drugs, such as magnesium sulphate. Fortunately, it is irritant to the stomach and acts as an emetic, but, if retained long enough to be absorbed, coma or paralysis may ensue. Sugar of lead has also been used in clarifying cider; and earthen vessels are glazed with a flux containing lead, so that the sources of lead poisoning are numerous. A case of lead poisoning in a young infant has been reported, caused by the mother's cleaning out the nursing-bottle with lead shot. Poisoning has also occurred from the use of cosmetics and hair-dyes containing lead. Lead is sometimes present in flour by reason of the mill-stones, by which the grain was ground, having been repaired by filling their cracks with lead. Chronic lead poisoning has been produced in children by swallowing the tin-foil in which certain kinds of candy are wrapped, which contains lead in large amount. A number of trades and occupations necessitate the handling of articles containing lead, and, therefore, give rise to cases of poisoning. Some persons are so susceptible that simply sleeping in a newly-painted room will impregnate the system. Wall-papers containing lead pigments have caused colic and miscarriage. Inhalation of the smoke given off by burning painted wood may also cause lead intoxication.

Physiological Action.—Given in medicinal doses, lead salts are sedative, astringent, and hæmostatic. They enter the blood, slow the heart and res-

piration, interfere with the nutritive functions of the red blood-corpuscles, and lead to their destruction, thus causing anæmia. Lead escapes from the blood by the skin, the liver, the kidneys, and intestinal tract. It is also found in the lacteal secretion. The excretion of uric acid is reduced, and thus lead favors the occurrence of gouty attacks in those predisposed. The excretion of urea is likewise diminished. The intemperate use of alcohol predisposes to attacks of plumbism upon exposure. Persons working amidst white lead may escape lead poisoning by using sulphuric-acid lemonade and fatty articles of food, and by frequent bathing. Sulphuric acid forms an insoluble compound with lead.

In some persons the topical application of solutions containing lead will cause brownish or blackish discolorations of the skin. Used internally, the preparations of this metal may occasion erythema or petechiæ.

Symptoms and Treatment of Lead Poisoning.—Acute lead poisoning following a single large dose of one of the salts of lead is very rare; but acute attacks as the result of slow absorption of the drug are very common. The most striking symptoms are obstinate constipation with cramps ("dry gripes"), loss of appetite, nausea, and vomiting of white, curd-like material, the color being due to the formation of lead chloride with the hydrochloric acid of the gastric juice. If the bowels open, the passages are of a blackish hue from the presence of sulphide of lead. The abdominal muscles are rigid and knotted and the wall of the abdomen is, in consequence, retracted. The intestines are shrunken, tenesmus is frequent, and alternate contraction and relaxation of the rectum can sometimes be felt. The liver is retracted and may even be diminished in size. The pulse is generally hard and tense on account, as Harnack supposes, of spasmodic contraction of the intestinal blood-vessels. Vertigo or headache may occur, and neuralgic attacks; even stupor and convulsions. Upon examination of the mouth, a **blue line** will be found in the gums near their margin, over the incisor teeth, caused by a deposit of the metal, or its sulphide, in the tissues. This line is particularly noticeable in those who neglect the care of their teeth. In some instances the conjunctiva becomes yellowish. Not infrequently there is redness and swelling of various joints. In rarer cases asthma or visceral disease has been produced by the absorption of lead. Various forms of paralysis may occur, the most common being "wrist-drop," or extensor paralysis of the muscles of the forearm. Electromuscular contractility is early affected, and may be lost before the power of voluntary movement. As a rule, the paralysis affects both wrists, the integument of which is frequently anæsthetic. Loss of sensibility may also occur at a distance from the paralyzed parts. Strabismus and aphonia have occurred and some cases have had a fatal termination from paralysis of the respiratory muscles. In some instances deafness is one of the results of saturnine intoxication. Hyperæsthesia or anæsthesia of the integument may be produced. A fatal case of lead poisoning has been reported[1] by Dr. G. L. Walton, in which ataxia was the prominent symptom. Three similar cases have been published by Dr. J. J. Putnam. Among the symptoms attending **plumbism**, or saturnism, are an offensive odor of the breath, pallor, emaciation, muscular pains, and loss of power. Plumbism is the frequent cause of abortion. The wives of workmen in lead factories frequently abort, even when they are not directly exposed to the influence

[1] *Boston Medical and Surgical Journal*, Oct. 30, 1890.

of the metal. According to the investigations of M. Paul, of fifty children born alive, the majority died within a few years after birth and only fourteen reached the age of ten years. Amenorrhœa likewise occurs among women exposed to the influence of lead.

More or less complete amblyopia may develop slowly or suddenly and may be associated with inflammation or atrophy of the optic nerve. Amaurosis and a train of nervous phenomena dependent upon alterations occurring in the brain (lead encephalopathy) appear from the influence of lead. A valuable memoir on the subject of cerebral symptoms due to lead intoxication has been published by Dr. Westphal.[1] Four forms have long been recognized under which the effects of the metal upon the brain are mainfested: the delirious, comatose, convulsive, and composite. The last named is by far the commonest, and in it the characters of the other three varieties appear to be united. Apoplectic and chorea-like forms have likewise been observed. Progressive paralysis, paresis of the laryngeal muscles, and a peculiar variety which runs a typhoid course have been described by different writers. From a careful study of thirteen cases, Westphal divided them into those which present general cerebral symptoms and those showing symptoms due to pressure. The first group were characterized by depressed spirits, dementia associated with melancholia, hypochondriasis, irritability, headache, and vertigo. Convulsions were very common, at times general, and again limited to certain groups of muscles. In five cases the spasms assumed a genuine epileptic character. Among pressure symptoms, the most frequent was paresis in districts supplied by certain cranial nerves. Disturbances of smell and vision, circulation and respiration, hemianæsthesia, and hemiparesis were observed. The author finally enumerates four modes in which lead acts upon the central nervous system: (1) by direct influence upon the brain, producing neuroses of various kinds, disturbances of intellection, and symptoms due to structural change; (2) by influence upon the blood-vessels, leading to hæmorrhage and softening; (3) by influence upon the kidneys, resulting in the cerebral symptoms of anæmia; (4) by a combination of the preceding methods.

According to experiments suggested by Prof. Thomas Oliver, hydrochloric acid is the active agent in promoting absorption of lead by the stomach. Pepsin rather diminishes than increases the amount of lead dissolved. The presence of proteids in gastric digestion also considerably reduces the quantity. Bile dissolves three times as much lead as the gastric juice. The presence of fat, however, reduces the quantity of the metal which passes into solution. The pancreatic fluid has no influence upon lead, whether alone or mixed with peptones, fat, or starch.

In obscure cases, suspected to be due to the influence of lead, the diagnosis may be positively made by means of a chemical examination of the urine for the presence of the metal.

Chorea, neuralgia, and spinal disease have at times been observed in chronic intoxication from lead. Cirrhosis of the liver, inflammation of the parotid gland, atrophy of the intestines, arthralgia, and contracted kidneys have also been due to the same influence. Acute and chronic asthma may be among the results of this species of poisoning. Facial palsy has been met with, and Dr. Putnam asserts that in children suffering from the effects

[1] See summary of his paper in the *Medical Bulletin*, Aug., 1889, p. 251, from *Deutsche medizinal-Zeitung*, May 9, 1889.

of lead the legs and feet are generally paralyzed. In all doubtful cases the urine should be carefully examined for the metal.

The post-mortem examination reveals chronic catarrh of the gastro-intestinal tract, thickening of the walls of the smaller arteries, interstitial inflammation of the kidneys, with the deposit of lead in the nerve-centres, and, in fact, in every part of the body. The lead, according to the experimental researches of Prevost and Binet, accumulates especially in the kidneys, though they have found it in most of the organs and tissues of the body. The longer the course of poisoning, the more lead is contained in the kidneys. The metal may be found in these organs long after the administration of the poison has ceased. The bones are rich in lead, which had been stored up in the form of a phosphate. The principal cerebral lesions of lead encephalopathy are atrophy of certain regions, hæmorrhagic deposits, apoplectic cysts, and, above all, alterations in the cerebral vessels, such as endo- and peri- arteritis, atheroma, and hyaline degeneration. Chronic plumbic intoxication is very apt to lay the foundation of kidney disease. It should not be overlooked that symptoms of lead poisoning may only be manifested after several months' exposure has occurred. Thus a case has been reported in which the symptoms of lead poisoning did not come on for six months after a painter ceased working at his trade. Several cases of this character have been reported, also, by Kauffmann (in the *Birmingham Medical Review*), in which the patients presented symptoms of lead poisoning a number of months after being exposed to the poison, in one instance after almost two years. An analysis of the urine in these cases showed the presence of lead, thereby proving that the diagnosis of the cause of the symptoms was correct.

The manner in which this curious delay occurs is obvious when we study the question of the elimination of lead. It is a substance which is eliminated from the body very slowly, indeed, and, like other metals, has a tendency to accumulate in the tissues, where it forms a fairly stable combination with the protoplasm, and probably also with uric acid, as is illustrated in the development of what has been called "plumbic gout." Further than this, almost every tissue of the body seems to be capable of containing it, though the muscles and blood contain less than any other part. In many instances it is evident that these delayed symptoms arise from the gradual deposit of lead in the tissues during the period in which the patient is in a condition of good health and nutrition, and that later on, when by reason of illness, bad food, or unsanitary surroundings, a portion of the protoplasm of the body is utilized for vital processes, the lead which has been deposited is picked up once more by the blood- and lymph- streams and distributed to the tissues, where it produces its effects. The editor of the *Journal of the American Medical Association* remarks that this matter is not only of importance from a medical point of view, but also because interesting medico-legal questions arise in connection with it. Thus, for example, a suit might be brought upon the part of a person who had been unwittingly exposed to lead with the development of symptoms a number of months afterward, and the defense might claim that it would be impossible for so long a period to elapse between the exposure and the development of plumbic symptoms. The cases just cited show, however, that this actually would not be a competent defense.

Treatment of Acute and Chronic Poisoning. — In lead colic we may

give 1.30 to 2.60 Gm. (or gr. xx-xl) of magnesium sulphate with 0.01 to 0.015 Gm. (or gr. $^1/_6$-$^1/_4$) of morphine, with syrup of ginger, and water enough to make a tablespoonful every hour or two, to relieve pain and constipation. Belladonna, or atropine, has also been found efficient in relieving the pain, while Bardenhewer recommends pilocarpine as rapidly accomplishing the same purpose. Alum is of value in the treatment of chronic lead poisoning. Where the lead is in the tissues, it may be slowly removed by the administration of small doses of potassium iodide, and by vapor-baths or Turkish baths, keeping up also the action of the kidneys. Baths containing potassium sulphide are also recommended. In the treatment of progressive saturnine paralysis, strychnine is of decided worth. Professor Oliver uses ferrous iodide if the patient is anæmic. Lithia, though of little avail as regards subduing pain, increases the amount of urine. For attacks of acute lead encephalopathy, this writer finds no treatment so efficacious as inhalation of amyl nitrite, which quickens the pulse, reduces arterial tension, and arrests convulsions. For suppression of the urine, he recommends pilocarpine. M. Lavrand also recommends ferrous iodide, either alone or associated with zinc phosphide as of value in arresting the progress of plumbism. The practice of massage favors the elimination of lead, and the galvanic current is also of efficacy.

Therapy.—Lead is used locally in the form of metallic plates in the treatment of leg-ulcers, with good effect, to repress exuberant granulations. Lead nitrate is employed in onychia with good result. As Goulard's solution, or cerate, it is applied to erysipelas, acute eczema, contusions, and inflammations of various kinds, but should be diluted. The early application of Goulard's solution is occasionally able to abort a felon. This liquid will often relieve itching, and is therefore of avail in paræsthesia and urticaria. Lead-water with laudanum was formerly much used to relieve pain and inflammation:—

℞ Liq. plumbi subacetatis diluti	30	c.cm. or fʒj.
Tr. opii	60	c.cm. or fʒij.
Aquæ destillatæ	240	c.cm. or fʒviij.

M. For external use.

Lead acetate is used for the same purpose, and also as an injection for gonorrhœa or leucorrhœa:—

℞ Plumbi acetatis		75 Gm. or gr. xij.
Zinci sulphatis		50 Gm. or gr. viij.
Aquæ rosæ	18	c.cm. or fʒvj.

M. Sig.: Use 4 to 15 c.cm. (or f3i-iv) as an injection every six hours for gonorrhœa or gleet.

℞ Plumbi acetatis		65 Gm. or gr. x.
Glycerini	15	c.cm. or fʒss.
Aq. hamamelidis dest.	30	c.cm. or fʒj.
Aquæ dest.	45	c.cm. or fʒiss.

M. Sig.: For injection, as directed.

℞ Plumbi acetatis		50 Gm. or gr. viij.
Phenolis liquefacti		13 Gm. or gr. ij.
Glycerini	15	c.cm. or fʒss.
Aquæ rosæ	105	c.cm. or fʒiiiss.

M. Sig.: For injection, as directed.

In many acute and chronic diseases of the skin, the various lead salts are most useful on account of their soothing and astringent action. The following formulæ are suggested:—

℞ Plumbi acetatis ..... 65 to 1 | 30 Gm. or gr. x vel xx.
Morphinæ sulphatis ..... | 32 Gm. or gr. v.
Mentholi ..... | 65 Gm. or gr. x.
Creosoti ..... | 60 c.cm. or *m*x.
Pulveris marantæ ..... 4 | Gm. or ʒj.
Ungt. zinci oxidi ..... 31 | Gm. or ℥j.

M. To be applied on a compress in subacute and chronic eczema.

℞ Plumbi carbonatis ..... 15 | 5 Gm. or ʒss.
Creosoti ..... | 60 c.cm. or *m*x.
Ol. olivæ, q. s. ft. ungt. mollis.

M. Useful in erysipelas, burns, and in bruises, especially when the skin assumes a blue or a dark tinge, for ecchymosis.

℞ Plumbi carbonatis ..... 8 | Gm. or ʒij.
Zinci carbonatis ..... 15 | 5 Gm. or ʒss.
Ol. eucalypti ..... | 30 c.cm. or *m*v.

M. A serviceable dusting-powder in acute eczema, herpes, and seborrhœa.

In the treatment of the muscular weakness or paralysis following the absorption of lead, besides potassium iodide and occasional purges of magnesium sulphate, with hot baths, etc., it is necessary to employ galvanism, to keep up the nutrition of the muscles and prevent fatty degeneration, and to employ systematic exercise, with massage. Semmola and others have published the details of a method by which the continuous current was successfully employed according to a systemic—as opposed to local—method, the poles being applied to the tongue and pit of the stomach. The sole reliance was placed upon galvanism, and no potassium iodide was employed. The blue line upon the gums disappeared at the end of about three weeks, and at the same time the muscles began to be capable of feeble movements. The method proved of no avail when cerebral symptoms were present.

Lead acetate fulfills a double purpose in the treatment of gastric ulcer. It checks hæmorrhage and at the same time promotes cicatrization. In the diarrhœa of typhoid fever and phthisis, this salt is an excellent remedy, and can be prescribed with service thus in ordinary diarrhœa, as well as in that from phthisis:—

℞ Plumbi acetatis,
Pulv. ipecacuanhæ et opii ..... aa 1 | 60 Gm. or gr. xxiv.

M. et ft. chartulæ no. xij.
Sig.: A powder every hour or two until improved, then every three or four hours.

℞ Plumbi acetatis ..... 1 | Gm. or gr. xv.
Tinct. opii ..... 7 | 5 c.cm. or f℥ij.
Tinct. catechu ..... 30 | c.cm. or f℥j.
Syr. zingiberis .....q. s. ad 90 | c.cm. or f℥iij.

M. Sig.: One to two teaspoonfuls in water every hour or two for diarrhœa. The dose for a child from two to six years old, from ten to thirty drops.

The acetate possesses some power, likewise, over the night-sweats of pulmonary disease. It is of service in chronic gastric catarrh and diminishes

the copious secretion of chronic bronchitis. Asthma associated with chronic bronchitis and the catarrhal stage of pertussis are relieved by the same preparation. Lead acetate has been found beneficial in dysentery, given either by the mouth or in the form of suppositories, as follows:—

℞ Plumbi acetatis,
Camphoræ ..... aa 2| Gm. or 3ss.
Extracti opii ..... |16 Gm. or gr. iiss.
Ol. theobromatis ..... q. s.

M. et ft. suppositoriæ no. x.
Sig.: Insert one into the bowel every hour or two for severe diarrhœa and dysentery, especially when attended with tenesmus.

Lead acetate is useful in hypertrophy of the heart on account of its power of retarding the action of that organ. From its influence upon the heart and its astringency, it is sometimes employed in the treatment of internal aneurism. Trocy advocates its use in pneumonia, especially when that disease attacks drunkards or persons of depressed vitality. He claims that the temperature and rate of respiration are lowered, and the disease is prevented from passing into a chronic form.

Lead iodide has been administered internally in order to reduce enlargement of the spleen due to malaria.

In conjunctivitis, dilute lead-water was formerly much used, but if ulceration of the cornea exist it may cause a permanent white patch. In diarrhœa and sporadic cholera, lead acetate and opium pills are of great service; and the acetate, in doses of 0.03 to 0.20 Gm. (or gr. ss-iij), is valuable in internal hæmorrhage or hæmoptysis.

A case of saturnine amblyopia is reported by Dr. C. B. Taylor in the *Lancet* (September 17, 1898). It was a young woman, who had been taking 0.65 Gm. (or gr. x) of lead plaster nightly for three weeks. The drug was taken with the object of producing an abortion, but it only produced blindness of one eye. Recovery followed the use of larger doses of potassium iodide, baths, pilocarpine, and the constant galvanic current to the temples (about 2 milliampères) daily.

Special Forms.—The glycerin of lead subacetate of the British Pharmacopœia is a good application to eczema. It corresponds in strength to Goulard's solution, but has glycerin as the menstruum. The liniment of the subacetate is also a good astringent application to inflamed skin, chapped hands, and bruises. White-lead paint is a good application to a burn or scald where the skin is unbroken. The ointment of lead iodide is used as a resolvent on glandular swellings, scrofulous tumors, goitre, etc., and also as an application in acne and other skin diseases. Dr. C. D. F. Phillips states that this ointment is especially serviceable in acute mastitis with threatened suppuration. It should be applied with steady friction. Chronic synovitis has likewise been benefited by the same preparation.

Lead nitrate, in very dilute solution, is useful as a wash in leucorrhœa, and to correct the fetid odor of discharges from ulcers, etc. Fissures of the nipples are cured by applications of a 2-per-cent. solution in glycerin, but great care must be exercised if a child is nursing from the affected breast, or lead poisoning may ensue. The oleate of lead melted with an equal amount of lard-oil is a useful application in eczema, acne, etc. Lead plaster is employed by surgeons to protect parts of the body exposed to chafing by splints or apparatus; it is also good to prevent bed-sores and as a base for

other plasters. Hebra's diachylon ointment[1] is made by melting equal parts, by weight, of lead plaster and linseed-oil, to which a proportion of balsam of Peru and a little oil of lavender are sometimes added. Diachylon ointment is serviceable in hyperidrosis. It should be spread upon pieces of linen large enough to cover the foot, and separate pieces placed between the toes. The foot is then covered with linen and bandaged, and this procedure is repeated every day for one or two weeks. This ointment often proves an excellent application also in subacute and acute eczema. In seborrhœa, dermatitis, herpes zoster, and sycosis, the use of lead ointment is attended with good results.

PODOPHYLLUM (U. S. P.).—**Podophyllum, May-apple, Mandrake.**

PODOPHYLLI RHIZOMA (B. P.).—**Podophyllum Rhizome.**

Preparations.

Fluidextractum Podophylli (U. S. P.).—Fluid Extract of Podophyllum. Dose, 0.60 to 2 c.cm. (or *m*x-xxx).

Resina Podophylli (U. S. P., B. P.).—Resin of Podophyllum. Dose, 0.008 to 0.065 Gm. (or gr. $^1/_8$-j).

Tinctura Podophylli (B. P.).—Tincture of Podophyllum (resin, 36.5 Gm. in 1000 c.cm.). Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Extractum Podophylli.—Extract of Podophyllum. Dose, 0.13 to 0.25 Gm. (or gr. ii-iv).

Pilulæ Podophylli, Belladonnæ, et Capsici (U. S. P.).—Pills of Podophyllum, Belladonna, and Capsicum. Dose, 1 or 2 pills.

Pharmacology.—"The dried rhizome of Podophyllum peltatum (Berberidaceæ)," growing in United States and Canada. This plant contains about 4 per cent. of resin (resina podophylli, U. S. P.), or podophyllin.

According to Podwissotzky, two active principles are present, a neutral crystalline substance, known as **Podophyllotoxin** ($C_{22}H_{24}O_9$), and **Picropodophyllin**, which are combined with an inert **podophyllic acid.** When treated with potassa, **pyrocatechuic acid** is obtained from the resin. It also contains a green oil, and sodium and potassium salts. By the action of ammonia upon podophyllotoxin this substance breaks up into picropodophyllin and podophyllic acid. **Podophyllotoxin** is a bitter, white, resinous powder, soluble in weak alcohol and in hot water, but is precipitated from alcoholic solution by cold water excess. The official resin of podophyllum consists of two resins, one soluble both in ether and in alcohol, the other only in alcohol. The former, comprising from 75 to 80 per cent., is the active part; the other, according to Cadbury, being without any effect. The resin is very irritant to the eyes, and when handled the dust is apt to cause conjunctivitis. The resin of podophyllum is insoluble in benzol, like that of jalap and scammony, but differs from these in being soluble in alkaline solutions, from which it may be precipitated by acids.

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[1] An improved process for making Hebra's diachylon ointment is given by Deringer: Dissolve lead acetate 200 grammes in 1 litre of distilled water and mix with 300 grammes of white Castile soap previously dissolved in 1 $^1/_2$ litres of warm, distilled water. Filter both solutions before mixing. The precipitate is then washed with water, freed as much as possible from water by kneading, and 1 part is melted with 1 $^1/_2$ parts of olive-oil on the warm bath. The mixture is then triturated in a mortar until it forms a fine, white salve.—"Proceedings of the American Pharmaceutical Association," 1881, p. 63.

A Himalayan plant, **Podophyllum emodi**, has been proposed as a source of the official resin. The analyses of John C. Umney show that, although it yields nearly double the amount of resin which can be extracted from Podophyllum peltatum, the resin, nevertheless, contains only about one-half the quantity of crystalline picropodophyllin. Dymock and Hooper found it to yield 12 per cent. of resin, which contains 50 per cent. of podophyllotoxin.

Physiological Action.—Podophyllum is a slow cathartic, acting upon the liver and the intestinal glands. It also exerts its purgative effects when introduced into the blood; also by absorption, when applied to a raw surface. In small doses it is laxative, in large doses drastic, and may cause gastro-enteritis. Podophyllotoxin has lately been isolated in a pure, crystalline form, and Neuberger has made an experimental study of its physiological action. Upon frogs and rabbits it has but little effect. Cats, however, proved extremely sensitive to its influence. Severe vomiting and diarrhœa occurred in a few hours after its administration. As death approached the animal became apathetic and paretic, and the temperature fell. Similar effects were produced in dogs. After death there was found great irritation, or even abscess, at the point of injection. The mucous membrane and adenoid tissue of the intestines were congested or inflamed; the liver and kidneys were swollen. Neuberger, therefore, concluded that the substance acts simply as an irritant, exciting catharsis in its elimination by the intestinal glands.

Therapy.—On account of the smallness of the dose and slight taste of the resin of podophyllum, it is very applicable to the treatment of constipation of young children, or the opposite condition of diarrhœa from want of proper secretion. A grain may be dissolved in 30 c.cm. (or f℥j) spirit of ginger, and a drop or two given on sugar. Proper caution, however, must be exercised in giving podophyllum or its constituents to children, as fatal accidents have occasionally happened in consequence of overdoses. It will also be found useful in adults, administered in the same manner, to check vomiting. In chronic constipation the following formulæ may be used:—

℞ Podophyllotoxini,
Aloini,
Extracti belladonnæ folior.,
Extracti ignatiæ ..... aa | 13 Gm. or gr. ij.
Extracti taraxaci ..... 2 | 60 Gm. or gr. xl.

M. et ft. pil. no. xx.
Sig.: A pill three times a day.

Bouchut recommends in infantile constipation this syrup:—

℞ Resinæ podophylli ..... | 048 Gm. or gr. $^{3}/_{4}$.
Alcoholis ..... 5 | c.cm. or f℥i $^{1}/_{4}$.
Syr. althææ ..... 90 | c.cm. or f℥iij.

M. Sig.: A dessertspoonful daily.

It is also useful in malarial liver disorders and jaundice, and in dyspepsia dependent upon deficient secretion of the liver and intestinal glands. In that form of sick headache associated with loose and dark-colored stools podophyllum generally affords relief.

The tincture of podophyllum, in small doses, is a useful remedy in cases of recurring tonsillitis, in "bilious" patients, those with sallow complexions,

coated tongue, and constipated bowels. The method used by eclectic practitioners is to add a few drops to half a glassful of water, and give a teaspoonful every hour or two during the day.

POLYGONATI RADIX.—Root of Solomon's Seal. The Polygonatum giganteum and P. biflorum (Liliaceæ), common plants in the eastern United States, have peculiar, boot-shaped rhizomes, bearing the scars of preceding leaf and flower-stalks, which look like the impress of a seal. They contain a bitter, acrid principle, **Convallarin**, with other vegetable constituents, such as tannin, mucilage, etc.

Physiological Action.—Slightly tonic, astringent, and alterative.

Therapy.—Used externally, in decoction or fluid extract, as an application to freckles, and for relieving bruises, sprains, and local inflammation; also as an injection for leucorrhœa, menorrhagia, and as a wash for hæmorrhoids. Internally, it has been used in rheumatism, gout, and dropsy. It is claimed to have special effects upon relaxed mucous membranes.

POLYGONUM. — Water-pepper, Smart-weed. The smart-weed, Polygonum hydropiperoides (Polygonaceæ), is a small, indigenous herb, with narrow, green leaves and spikes of small, greenish or white flowers. It contains **Polygonic Acid**, an acrid principle insoluble in water, with tannin, etc. The active principle is dissipated by heat, and therefore an alcoholic tincture of the fresh plant is the best form, or a well-made fluid extract. The dose of the fluid extract is from 0.60 to 4 c.cm. (or *mx*-f3j). A solid extract has also been prepared, the dose of which is from 0.065 to 0.32 Gm. (or gr. i-v).

Physiological Action.—Polygonum has a burning, acrid taste; inflames the skin when rubbed upon it; and internally has stimulating effects, especially to the ovarian functions and to the kidneys. Polygonum increases the number and strength of the cardiac contractions, promotes and increases the capillary circulation, and causes warmth of the surface, accompanied by an increase of perspiration.

Therapy.—Employed in domestic practice, externally as counter-irritant and internally as an emmenagogue, 2 c.cm. (or f3ss) doses of the fluid extract being administered for several days before the expected period, in amenorrhœa. Water-pepper is likewise of service in functional impotence. On account of its diuretic virtue, it has been employed for the purpose of washing out sand or gravel from the kidneys or bladder. It has also been used in diarrhœa, bronchitis, and catarrhal disorders.

A poultice made with water or vinegar from the leaves of Polygonum persicaria has been found an excellent anodyne application by Professor Flagg. In dental practice he recommends the warm poultice as beneficial in facial neuralgia, while, applied cool, it relieves pathological conditions attending the eruption of the lower wisdom-tooth.

POLYTRICHIUM.—Haircap Moss. Polytrichium juniperinum (Musci) is a mossy plant, growing abundantly throughout North America, in marshy places. A fluid extract may be used in the dose of 4 to 7.50 c.cm. (or f3i-ij).

Physiological Action and Therapy.—The taste of polytrichium is somewhat pungent, but not acrid. Dr. Eckfeldt states that it has a certain nauseant effect, is alterative, and a diuretic of considerable power. He declares that the use of the drug for a few days causes an appreciable loss of weight,

and that its physiological action merits a closer investigation than it has yet received. Dr. Eckfeldt has employed polytrichium with advantage in dropsical conditions due to disease of the liver or kidneys. Its effects are increased by combination with a diuretic or hydragogic cathartic.

POPULI CORTEX.—White Poplar-bark, American Aspen. The Populus tremuloids (Salicaceæ), a forest-tree of the United States, contains in its bark **Populin**, a bitter principle, resembling quinine or cinchonine in its physiological and therapeutical effects. Poplar-bark has been used as a tonic and antiperiodic in doses of 2 to 5 Gm. (or gr. xxx-lxxv) several times a day in decoction or fluid extract. A solid extract may be obtained by evaporating the fluid extract to pilular consistence. Dose, 0.13 to 0.75 Gm. (or gr. ii-xij).

The terminal buds of the poplar have a balsamic odor, and contain volatile oil having the odor of chamomile, resins, etc., and possess the medicinal properties of terebinthinate substances. The ointment of poplar-buds (made by digesting freshly-bruised poplar-buds with twice their weight of hot lard, and gently boiling until all moisture is dissipated) is a fragrant ointment resembling benzoinated lard in antiseptic qualities.

POTASSIUM.—The metal **Potassium**, or **Kalium (K).**

Salts and Preparations.

Potassii Hydroxidum (U. S. P.), Potassa Caustica (B. P.).—Caustic Potash, Potassium Hydrate, Potassium Hydroxide.

Liquor Potassii Hydroxidum (U. S. P.), Liquor Potassæ (B. P.).—Solution of potassium hydroxide (5 per cent.). Dose, 0.65 to 4 Gm. (or gr. x-3j).

Antimonii et Potassii Tartras (U. S. P.), Antimonium Tartaratum (B. P.).—Antimony and Potassium Tartrate, Tartar Emetic. Dose, 0.0015 to 0.065 Gm. (or gr. $^1/_{40}$-j).

Potassii et Sodii Tartras (U. S. P.), Soda Tartarata (B. P.).—Potassium and Sodium Tartrate, Rochelle Salt. Dose, 1.30 to 15.5 Gm. (or gr. xx-3iv).

Potassii Citras Effervescens (U. S. P.).—Effervescent Potassium Citrate. Dose, 2 to 6 Gm. (or 3ss-iss).

Liquor Potassii Citratis (U. S. P.).—Solution of Potassium Citrate.

(Effervescing draught is the extemporaneous solution of potassium citrate, made by mixing equal quantities of two solutions, one containing 6 Gm. of citric acid to 50 c.cm.; the other 8 Gm. of potassium bicarbonate to 50 c.cm. It contains about 9 per cent. of anhydrous potassium citrate, with a little free citric and carbonic acids.) Dose, 15 to 30 c.cm. (or f℥ss-j).

Argenti Nitras Mitigatus (U. S. P., B. P.).—Mitigated Caustic (contains potassium nitrate, 2 parts, to silver nitrate, 1 part).

Pulvis Effervescens Compositus (U. S. P.).—Pulvis Sodæ Tartaratæ Effervescens (B. P.).—Seidlitz Powder (sodium bicarbonate, 2.58 Gm., or gr. xl, and Rochelle salt, 7.75 Gm., or 3ij, in a paper together; tartaric acid, 2.25 Gm., or gr. xxxviij, in a separate paper. Dissolve separately in water and mix). Dose, 1 pair taken while effervescing.

Liquor Potassii Arsenitis (U. S. P.), Liquor Arsenicalis (B. P.).—Solution of Potassium Arsenite. Fowler's Solution (strength corresponding to arsenic trioxide 1 per cent.). Dose, 0.06 to 0.60 c.cm. (or *m*i-x).

Ferri et Potassii Tartras (U. S. P.), Ferrum Tartaratum (B. P.).—Iron and Potassium Tartrate. Dose, 0.32 to 1 Gm. (or gr. v-xv).

Potassii Bitartras (U. S. P.), Potassii Tartras Acidus (B. P.).—Potassium Bitartrate, Cream of Tartar. Dose, 1.30 to 15.5 Gm. (or gr. xx-3iv).

Potassii Cyanidum (U. S. P.).—Potassium Cyanide. Dose, 0.005 Gm. (or gr. $^1/_{12}$).

Potassii Ferrocyanidum (U. S. P.).—Potassium Ferrocyanide, or Yellow Prussiate of Potash. Dose, 0.65 Gm. (or gr. x).

Potassii Acetas (U. S. P., B. P.).—Potassium Acetate. Dose, 0.65 to 4 Gm. (or gr. x-3j).

Potassii Hypophosphis (U. S. P.).—Potassium Hypophosphite. Dose, 0.13 to 2 Gm. (or gr. ii-xxx).

Syrupus Hypophosphitum (U. S. P.).—Syrup of the Hypophosphites. Dose, 2 to 7.5 c.cm. (or f3ss-ij).

Potassii Dichromas (U. S. P., B. P.).—Potassium Dichromate. Dose, 0.012 Gm. (or gr. $^1/_6$).

Potassii Bromidum (U. S. P., B. P.).—Potassium Bromide. Dose, 0.65 to 2 Gm. (or gr. x-3ss).

Potassii Bicarbonas (U. S. P., B. P.).—Potassium Bicarbonate. Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Potassii Carbonas (U. S. P., B. P.).—Potassium Carbonate, Salt of Tartar. Dose, 0.13 to 1.30 Gm. (or gr. ii-xx).

Potassii Chloras (U. S. P., B. P.).—Potassium Chlorate. Dose, 0.13 to 0.65 Gm. (or gr. ii-x).

Potassii Citras (U. S. P., B. P.).—Potassium Citrate. Dose, 0.65 to 2.60 Gm. (or gr. x-xl).

Potassii Iodidum (U. S. P., B. P.).—Potassium Iodide. Dose, 0.32 to 2.60 Gm. (or gr. v-xl).

Potassii Nitras (U. S. P., B. P.).—Potassium Nitrate, Saltpetre. Dose, 0.13 to 1.30 Gm. (or gr. ii-xx).

Potassii Permanganas (U. S. P., B. P.).—Potassium Permanganate. Dose, 0.03 to 0.13 Gm. (or gr. ss-ij).

Potassii Sulphas (U. S. P., B. P.).—Potassium Sulphate. Dose, 1.30 to 4 Gm. (or gr. xx-3j).

Potassa Sulphurata (B. P.).—Sulphurated Potassa, Liver of Sulphur. Dose, 0.13 to 0.50 Gm. (or gr. ii-viij).

Pulvis Jalapæ Compositus (U. S. P., B. P.).—Compound Jalap Powder (U. S. P. contains 65 parts of cream of tartar and 35 of jalap). Dose, 0.65 to 1.30 Gm. (or gr. x-xx). (B. P. is jalap 5, acid potassium tartrate 9, and ginger 1 part.)

Trochisci Potassii Chloratis (U. S. P., B. P.).—Troches of Potassium Chlorate (each containing 0.15 Gm., or gr. ij½, of potassium chlorate; the B. P. formula contains 0.20 Gm., or gr. iij, with rose basis).

Tinctura Iodi (U. S. P., B. P.).—Tincture of iodine. (Contains potassium iodide.)

Unguentum Potassii Iodidi (U. S. P., B. P.).—Ointment of Potassium Iodide (potassium iodide, 12; sodium hyposulphite, 1; water, 10; benzoinated lard, 77 parts. The B. P. formula contains 5 Gm. in 40 Gm.).

Potassii Tartras (B. P.).—Potassium Tartrate. Dose, 2 to 15.5 Gm. (or gr. xxx-3iv).

Liquor Potassii Permanganatis (B. P.).—Solution of Potassium Permanganate (1 per cent.). Dose, 7.5 to 15 c.cm. (or f3ii-iv).

Confectio Sulphuris (B. P.).—Confection of Sulphur (sublimed sulphur, 100 Gm.; cream of tartar, 25 Gm.; tragacanth, 1 Gm.; syrup, 50 c.cm.; tincture of orange, 12.5 c.cm.; glycerin, 37.5 c.cm.). Dose, 4 to 8 Gm. (or 3i-ij).

Linimentum Potassii Iodidi cum Sapone (B. P.).—Liniment of Potassium Iodide with Soap (about 10 per cent. of potassium iodide).

Potassa cum Calce.—Potassa with Lime. Vienna Paste (equal parts potassium hydrate and lime). Escharotic.

Pharmacology.—Potassium salts exist in certain minerals, but they are derived principally from the ashes of plants; they are also present in animal tissues, especially in the muscles. Potassium is a white metal discovered by Sir Humphry Davy in 1807. It decomposes water with such violence when brought into contact with it that it ignites the hydrogen, burning with a red flame and forming the hydrate or caustic potash, which is a most powerful alkaline base, soluble in half its weight of water. When dissolved in 20 parts of water it forms liquor potassæ. Potassium chlorate, when triturated in a mortar with sugar, sulphur, tannin, charcoal, glycerin, and numerous other substances, and occasionally even triturated alone, is liable

to explode; and therefore, in making the troches, the United States Pharmacopœia directs that the chlorate shall be added to the other ingredients last and mixed carefully by means of a horn spatula. The troches sometimes explode spontaneously. At all events, the U. S. P. proportion is too large; there need not be more than 0.065 to 0.13 Gm. (or gr. i-ij) in each lozenge. The dicromate also forms an explosive mixture with glycerin. The salts of potassium are usually colorless or white, and are generally soluble in water; some of them are deliquescent.

Physiological Action.—Caustic potash abstracts water and fat from the tissues and produces a soft eschar when applied to the skin, which is subsequently separated by inflammation from the uninjured parts. This substance, moreover, dissolves the albuminous constituents of parts with which it is brought into contact. Taken internally in concentrated form, it is a corrosive mineral poison, destroying the soft parts and causing much irritation and secondary inflammation of the larynx or œsophagus, leading to stricture and gastritis. Even by liquor potassæ these symptoms may be produced, unless the remedy be very largely diluted. The carbonate is a powerful antacid, both in the intestinal tract and in the blood, favoring the expulsion of uric acid, with which it forms salts more soluble than those of sodium; the bicarbonate, however, is preferable for internal administration, being more acceptable to the stomach. Under its use the urine becomes alkaline.

Potassium is a cardiac poison; it is a muscle- and nerve-paralyzer through an influence upon protoplasm, and is destructive to the ozonizing function of red blood-corpuscles. These effects are shown to a different degree by different salts, and vary with the dose. In physiological doses, they increase the secretions, stimulate retrograde metamorphosis, and promote oxidation; if too long continued, they produce anæmia and wasting of the body. Small doses of the bicarbonate, taken before meals, stimulate the secretion of gastric juice and make the urine more acid; larger doses disorder digestion, are partly decomposed by the gastric juice, which is made less acid, and partly enter the blood, increasing its alkalinity and the alkalinity of the urine also. In rare instances potassium bicarbonate has occasioned a vesicular eruption similar to that of eczema. The potassium salts with vegetable acids are generally decomposed in the blood, the vegetable acid being destroyed, the base combining with carbonic acid and escaping in the urine, which it renders alkaline. The salts with mineral acids are not decomposed, but in passing through the body exercise more or less effect upon the blood and certain organs. The nitrate, in large doses, exerts a paralyzing influence upon the spinal cord, and produces great muscular weakness and reduction of reflex sensibility. In moderate doses the nitrate raises arterial tension and slows the heart's action, but larger doses weaken its movements and finally arrest them. The fibrin of the blood is less coagulable and the red blood-corpuscles have their oxygen-carrying powers reduced. The urine is increased in quantity. Death has sometimes been caused by the nitrate in consequence of its irritant effect upon the gastro-intestinal mucous membrane. According to the experiments of Aubert and Dehn, most of the potassium salts, with the exception of the permanganate, have the same effect as the nitrate upon the circulation.

Potassium chlorate acts like the nitrate upon the spinal cord, but has a more profound action upon the blood, disintegrating the corpuscles and

making it of a chocolate color (methæmaglobinæmia). Taken in toxic doses, vomiting, with hæmatemesis, delirium, hæmatogenous jaundice, and coma result. The bodily temperature is markedly depressed by large doses of the salts of potassium, and especially by the nitrate and chlorate. Professor Albrecht[1] reported a case of a boy, three years of age, suffering with stomatitis and diarrhœa, in whom two doses of 0.50 Gm. (or gr. viij), given on successive days, caused death by collapse, with methæmaglobinæmia. Landerer[2] reports a case of a boy, 18 years of age, who, for tonsillitis, had been given 30 Gm. (or gr. 460) of potassium chlorate, to be dissolved in water and used as a gargle. He dissolved the whole in hot water and drank it in two portions within half an hour, in the evening. He subsequently was faint and extremely thirsty, and drank some beer, which produced violent vomiting through the night and pain in both hypochondria. Next morning he came to the hospital, with headache, faintness, and constipation. His skin was anæmic, eyes and lips cyanotic; he had rigors and slight jaundice. The liver was slightly enlarged; there was pain over the stomach and kidneys. The urine was very small in quantity, only about 4 c.cm. (or f3j); very albuminous, and deposited a brown sediment of altered blood-corpuscles. On filtration, the color was dark-cherry red. It gave the guaiac reaction and, on spectroscopical examination, the lines of methæmoglobin. Blood from the finger also showed altered blood-disks in masses, as well as unaltered blood-corpuscles, which formed imperfect *rouleaux*. Death occurred six days later, without convulsions or special anæmic symptoms. During this time suppression of urine continued. The lesions, post-mortem, were distributed through the body, but chiefly seen in the intestinal tract (which was hyperæmic, inflamed, and eroded in places) and in the kidneys (which were much enlarged, œdematous, capsule adherent, blood-vessels overfilled, the tubes plugged with brownish masses, to which some detached epithelial cells adhered). The liver and spleen were also enlarged. The symptoms appear to be primarily dependent upon excessive blood-destruction, blocking up the urinary tubules with the *detritus*, and the consequent nephritis and anæmia. Jaundice and cyanosis were due to the same cause. As a rational treatment, Landerer advises blood-letting, followed by transfusion. The preceding case is presented here as a typical illustration of the effects of potassium chlorate when taken in a poisonous dose. In many cases death occurs earlier from collapse; in others the patient becomes cyanosed and prostrated, but slowly recovers after stopping the medicine and using antidotes. It was formerly thought that the chlorate, which contains a large proportion of oxygen, was capable of yielding some of it to the tissues, but this is not now believed possible, as the salt is excreted unchanged very largely by means of the salivary glands. In giving potassium chlorate its effects should always be closely observed, and, if drowsiness and scantiness or suppression of urine supervene, the remedy should be at once discontinued. One of the rare effects of ingestion of potassium chlorate is the occurrence of an erythematous, petechial,[3] vesicular, or papular eruption. It is evident that susceptibility varies, as some patients take with impunity quantities that are fatal to others.

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[1] *Lancet*, Dec. 30, 1905.
[2] *British Medical Journal*, Dec. 13, 1890.
[3] *Journal of the American Medical Association*, July 22, 1905.

The nitrate, likewise, passes through the body unchanged. The treatment of poisoning will be considered in the next paragraph. The sulphate is a powerful purgative, but is too irritant to be used for this purpose, except in veterinary practice, and less pleasant than Rochelle salt. The bitartrate, or cream of tartar, is diuretic as well as laxative. It is an ingredient in the compound jalap powder, which is a very safe and efficient cathartic in dropsy attending heart or kidney disease. The salts of potassium are eliminated principally by the kidneys, though the salivary, mammary, and sudoriparous glands also assist in their removal. A portion is also believed to escape by the bowels, as the nitrate has been detected by Dr. Kramer in the fæces of animals to which it was administered.

Potassium cyanide is very toxic in its effects. Death has resulted from doses of 0.20 to 0.32 (or gr. iij-v). Inhalation of fumes of an alloy of gold with cyanide of potassium caused death in half an hour, with symptoms of cerebral congestion.[1]

Treatment of Poisoning by Potassium Salts.—Poisoning by potassium cyanide is not very frequent, but it occasionally occurs, the symptoms and treatment being those of hydrocyanic-acid poisoning. Alkalies should be promptly administered to prevent decomposition of the salt by the acid gastric juice, and the stomach and intestinal canal emptied as soon as possible, followed by the administration of arterial stimulants, such as coffee and ammonia, with cold affusions to the spine and friction of extremities. Death is generally almost instantaneous. When taken accidentally, prompt treatment may be successful. The stomach-pump should be used to wash out the stomach, followed by antidotes for prussic acid (ferric and ferrous sulphate with potassium carbonate, inhalation of ammonia, etc.).

Potassium ferrocyanide is decomposed even by weak acids, with the liberation of hydrocyanic acid. Acids should, therefore, not be taken after the ingestion of the salt. Cases are on record in which death has been caused by this mistake.

When caustic potash has been swallowed, it is necessary to use demulcents freely, with vinegar as a chemical antidote, and encourage vomiting, giving digitalis and stimulants hypodermically to sustain the heart. After death there is found inflammation, with softening, erosion, and sometimes perforation of the stomach. Death may ensue from shock, cardiac paralysis, or inflammation of the stomach and intestines. Potassium chlorate causes death by depression of vital powers, due to its destructive action upon the blood and the congestive obstruction of the kidneys. The treatment is by saline purgatives and diuretics, especially calomel and caffeine, with hot baths, and, in case there is much cyanosis, transfusion of blood. Potassium bromide causes gastralgia occasionally when taken into an empty stomach; this is relieved by hot drinks and carminatives.

Therapy.—Although an efficient escharotic, caustic potash is not often used, because it produces a burn that is attended by a good deal of inflammation and pain. It was formerly the custom, in the treatment of diseases of internal organs, to establish an issue by application of caustic potash, and the resulting ulcer was kept irritated by a dried pea or a small piece of orris-root; but this practice is rarely resorted to at present. On account of the powerful, extensive, and penetrating action of this substance, it should never

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[1] J. A. Post in *New York Medical Journal*, April, 1876.

be used without precautionary measures being taken for the purpose of limiting its effects. A hole cut in a piece of adhesive plaster, or in several pieces overlying each other, then placed upon the skin, is a simple device by which the application of the caustic may be circumscribed. Nor should it be left long in contact with the integument, since its influence continues for some hours after it has been removed. When the integument acquires a bluish tinge, and the epiderm is softened, it is time that the remedy should be discontinued. The spot should then be washed with some weakened vinegar, in order to neutralize any alkali which might remain. Finally, a poultice is applied to the area of action. Surgeons use caustic potash in treating fistula in and after operation, in order to prevent immediate union; also to soften ingrowing toe-nails. Dr. Pürckhauer, of Bamberg,[1] describes a method which he has used with entire success in the treatment of this painful affection. The portion of nail which needs to be removed is painted with a 40-per-cent. solution of caustic potash. At the end of a few seconds the upper layer of the nail has become so soft that it can be easily scraped off with a sharp-edged piece of glass. The procedure is repeated until all that remains of that portion of the nail is a thin scale, which can be excised by means of a pair of fine scissors. A valuable advantage of this practice is that the patient is able to follow his usual vocation without the loss of any time.

In concentrated form, potassium permanganate acts as a caustic, and may cause corrosive poisoning. In the *Medical Bulletin* for February, 1906, a case is reported from the author's clinic, in which forty grains produced collapse, semiunconsciousness, and delirium. The successful treatment consisted in evacuating the stomach; strychnine hypodermically, an enema of whisky and water, and a diet restricted to albumin and milk. A weak solution of potassium permanganate (0. 065 to 0.32 Gm. in 30 c.cm., or gr. i-v to f℥j) was formerly known as Condy's fluid; it is an oxidizing disinfectant, and a useful agent in dilute solution for irrigating wounds or ulcers. A solution of this substance is a serviceable application to the throat in diphtheria and scarlet fever. Potassium permanganate is recommended by Weir Mitchell as the best antidote to the venom of snake-bite, provided that it can be brought into direct contact with the virus before absorption, and has been commended by Dr. William Moor as an antidote to morphine. For internal use the solutions must be greatly diluted.

The permanganate, and caustic potash as well, have been employed with a view to neutralizing or destroying the poison of rabid animals, though the results have not been encouraging. A solution of the permanganate is an efficient deodorizer in ozæna and inflammation of the middle ear. The solution should be only of a pink color for irrigation. Potassium bicarbonate is a good lotion (4 Gm. to 473 c.cm., or ʒi-Oj) for eczema and rheumatic joints, and in stronger solution as an application in pruritus vulvæ, and to bites of animals or insect-stings.

In cases of pruritus, Dr. E. B. Bronson, of New York, often employs a lotion composed of:—

R Phenolis liq.	4| to 8|	c.cm.	or f℥i-ij.
Liq. potass. hydroxidi	4|	c.cm.	or f℥j.
Ol. lini	30|	c.cm.	or f℥j.

M. Sig.: Shake before using. A drop or two of bergamot oil may be added in order to overcome the odor of the linseed-oil.

[1] See *Medical Bulletin*, March, 1891.

In eczema of the vulva, Lusch recommends the following formula:—

℞ Potass. bicarb.	4	Gm. or ʒj.
Sodii bicarb.	8	Gm. or ʒij.
Glycerin.	6	c.cm. or fʒiss.
Tr. opii	7.5	c.cm. or fʒij.
Aquæ	240	c.cm. or fʒviij.

M. Sig.: For use, night and mornings, as a lotion.

Leucorrhœa, dependent upon the excessive functional activity of the glands of the cervix uteri, is markedly benefited by vaginal injections of weak solutions of potassium bicarbonate. The same solution has been used, to wash out the bladder in order to relieve the cystitis attending uric-acid calculi. Sulphate of zinc, alum, and potassium permanganate may be combined in a powder, to be dissolved (a teaspoonful to a quart of hot water), and used as a vaginal douche.

Potassium dichromate, in solution, is a good application to warts and corns and to venereal excrescences of mucous patches. It is largely used with sulphuric acid as a battery-fluid, and accidents occur by swallowing some of the fluid; the symptoms of irritant corrosive poisoning at once appear, with vomiting, pain, and restlessness, requiring the use of demulcents and anodynes, and free evacuation of the stomach and bowels. Dr. J. E. Weaver considers dichromate of potassium especially useful in both laryngitis and bronchitis, if secretion is stringy and hard to raise. After the second or third dose the expectoration becomes loose and easy. In tonsillitis, where the onset is rapid, the tonsils rough, raw, and angry looking, with muco-purulent secretions exuding from the follicles, also, in cases of non-diphtheritic, pseudomembranous tonsillitis, this remedy he regards as a specific. In treating laryngitis and bronchitis with this remedy one must be careful not to use it too strong—not more than 0.065 Gm. (or gr. j) well diluted in 90 or 120 c.cm. (or fʒiii-iv) of water, a teaspoonful every one-half to two hours. But in tonsillitis, the finely-powdered dichromate should be added to the water until the latter is of a dark-lemon or light-orange shade, and of this a teaspoonful should be given every hour. In these cases the only limit to the administration of the drug is nausea. If this symptom appears, lessen the dose. After the third or fourth dose improvement should be noticed.

Internally, where alkalies are required, the salts of potassium have been very largely used. In acid dyspepsia, the bicarbonate, in considerable doses after meals, neutralizes the excess of acid and relieves heartburn and pyrosis; while small doses, before meals, in atonic dyspepsia, stimulate the free secretion of an acid gastric juice. In some cases of gastralgia the pain may be relieved by the bicarbonate in some effervescent water. The same salt is of value in the indigestion of obese individuals, also of rheumatic and gouty subjects. It is of material assistance, moreover, in the digestion of fatty food.

In dyspepsia, accompanied by hyperacidity with pain or vertigo, Robin prescribes:—

℞ Potass. bitart.	12	Gm. or ʒiij.
Sulphur. sublimati	5	Gm. or ʒi 1/4.
Cretæ preparatæ	2	Gm. or ʒss.
Pulv. ipecac. et opii	1	Gm. or gr. xv.

M. et div. in chartulæ no. x.
Sig.: One powder after each meal.

In diarrhœa, excited by an excessive quantity of acid in the bowel, potassium bicarbonate is an efficacious remedy. The carbonate in doses of 0.065 to 0.13 Gm. (or gr. i-ij) several times a day is a remedy of some utility in whooping-cough. In some forms of bronchitis, especially in gouty persons, the liquor potassæ is a good addition to a cough-mixture, to liquefy the mucus and facilitate expectoration:—

℞ Liquoris potassæ hydroxidi	4	c.cm. or f℥j.
Syr. senegæ	30	c.cm. or f℥j.
Mist. glycyrrhizæ co.	q. s. ad 180	c.cm. or f℥vj.

M. Sig.: Take a dessertspoonful in a wineglassful of water every three hours for bronchitis, with scanty and tough expectoration.

As the urine is rendered alkaline under its use, liquor potassæ is frequently combined with other remedies in treating gonorrhœa: —

℞ Liquoris potassæ hydroxidi,		
Copaibæ	aa 22	c.cm. or f℥vj.
Mucilag. acaciæ	90	c.cm. or f℥iij.
Spiritus ætheris nitrosi	22	c.cm. or f℥vj.
Tincturæ opii	4	c.cm. or f℥j.
Aquæ	q. s. ad 180	c.cm. or f℥vj.

M. Sig.: Take a tablespoonful well diluted, three or four times daily, in acute gonorrhœa.

In cystitis and pyelonephritis the same combination can be used, in order to render the urine less irritating. If, however, in cystitis, alkaline decomposition has occurred, the administration of alkaline remedies will, as Ringer points out, aggravate the disorder by assisting the transformation of urea into ammonium carbonate. The alkaline treatment in acute rheumatism is suited to plethoric subjects, with strongly-acid perspiration. The bicarbonate is used in doses of 1.30 or 2 Gm. (or gr. xx-xxx) every four or five hours in cinnamon-water, or the citrate or acetate may be given in full doses. If the system be alkalinized early in the disease, there is less danger of cardiac complication. Very often the treatment is best begun with potassium iodide for a day or two, and then the bicarbonate is substituted. The iodide is of special value in chronic rheumatism in 0.65 Gm. (or gr. x) doses, with compound syrup of sarsaparilla and water, three times a day. The carbonate may be added to a warm bath for rheumatic cases with benefit, especially in diseases of the skin of rheumatic origin. Potassium acetate is the most diuretic of these salts, and is useful in œdema, ascites, and other effusions:—

℞ Potassii acetat.	15|5	Gm. or ℥iv.
Fluidextracti pilocarpi	|6	c.cm. or f℥iss.
Spt. junip. co.	60	c.cm. or f℥ij.

M. Sig.: A dessertspoonful in water, every two hours, in suppression of urine.

The salt may also be used with advantage in cases of functional inactivity of the liver. In lithæmia and disorders of the urinary secretion we obtain good results from the administration of the citrate or bitartrate:—

℞ Potassii bitartrat. (crystals)	15|5	Gm. or ʒss.
Infus. juniperi *vel* scoparii	473	c.cm. or Oj.

M. et ft. sol.

Sig.: To be taken at intervals during the day, to increase the flow of urine.

The diuretic properties of the bitartrate render it valuable in chronic Bright's disease. For the same reason this salt is of advantage in the treat-

ment of puerperal eclampsia. Both the bitartrate and acetate are of avail in œdema dependent upon disease of the heart. The deposition of uric acid and formation of stone in the bladder may be prevented by the persistent administration of an alkali, and it is probable that small calculi or uric acid gravel may thus be dissolved within the bladder. Continued alkalinity of the urine is best maintained by means of the citrate, as that salt is less apt to derange the functions of the stomach or exert a deleterious influence upon the blood-corpuscles.

℞ Potassii citrat.,
Lithii citrat. ..... aa 8| Gm. or ʒij.
M. Div. in chartulæ no. xxiv.
Sig.: Take one in a glass of Vichy water, every four hours, in lithæmia.

In hæmorrhoids the following is a useful laxative:—

℞ Potassii bitartrat. ..... 31| Gm. or ʒj.
Sulphuris loti,
Pulv. aromat. ..... aa 15|5 Gm. or ʒss.
M. Sig.: A teaspoonful once or twice daily, made into a bolus with orange-syrup.

Sir William Gull esteemed potassium bitartrate as "of singular value in alcoholic cirrhosis." Good results have also been obtained from its use in the same affection when dependent upon other causes, and also in chronic peritonitis.

Potassium citrate is of service in the first stage of acute bronchitis, and in the form of neutral mixture or effervescing draught it affords marked relief to the nausea and vomiting which accompany febrile affections. It is, likewise, well adapted to the irritable stomach of phthisis. Incontinence, from a too concentrated condition of the urine, is benefited by its administration. Potassium and sodium tartrate, or Rochelle salt, is a very useful laxative, and is serviceable in fevers. It is the purgative constituent in Seidlitz powders, which are most efficient taken early in the morning, when the stomach is empty. Except as a constituent of some mineral waters, potassium sulphate is not used as a purgative; its action is too severe, and it is very bitter. Being a hard and dry powder, the sulphate is utilized in pharmacy for the trituration of powders and pill-masses. Potassium nitrate in small doses reduces temperature, and the force and frequency of the heart's action, and is useful in the treatment of pneumonia, as in the following combination:—

℞ Antimonii et potassii tartratis ..... |015 Gm. or gr. ¼.
Potassii nitrat. ..... |20 Gm. or gr. iij.
Pulv. ipecac. et opii ..... |065 to |13 to |32 Gm. or gr. i-ii-v
M. et ft. chartula no. j. Mitte tales no. xij.
Sig.: Take one every two or three hours. This acts upon the skin and relieves cough, and is far preferable to the coal-tar compounds on the score of safety.

Potassium nitrate is also used in acute rheumatism. Unsized paper, saturated in a solution of nitre, may be burned, and its fumes inhaled, with good results in asthma. According to M. Corson, 0.13 Gm. (or gr. ij), of potassium nitrate in a glass of sugar water, will relieve the hoarseness to which speakers and singers are liable. Dr. Peter Buro, of Arva-Polhora, asserts as a result of clinical experience, that potassium nitrate is a specific remedy in typical malarial intermittent, of whatever form. He administers

it to adults in single doses of 1 to 1.55 Gm. (or gr. xv-xxiv) in either the febrile or non-febrile stage, and states that it gives rise to no disturbance of the digestive organs or nervous system. This salt is sometimes of value in the treatment of hæmorrhage. In hæmoptysis accompanied by febrile excitement, it has been prescribed with advantage. In purpura simplex 0.65 Gm. (or gr. x) doses, and in purpura hæmorrhagica from 0.65 to 4 Gm. (or gr. (x-5j) doses have been reported as successful. Lauder Brunton recommends for overcoming increased arterial tension:—

℞ Potassii bicarb. ..... 1|80 Gm. or gr. xxviij.
Potassii nitratis..... 1|15 Gm. or gr. xviij.
Sodii nitritis..... |28 Gm. or gr. ivss.
To be taken, dissolved in a glassful of water, on rising each morning.

The compound solution of phosphate of soda contains potassium nitrate. Potassium nitrite is depressing to the circulation, resembling nitroglycerin, according to Atkinson.[1] It may be substituted for the latter in the treatment of neuralgic heart affections (angina pectoris) and in epilepsy, in doses of 0.20 to 0.32 Gm. (or gr. iii-v). In asthma, it also may be given in conjunction with inhalation of nitre-paper fumes. Potassium cyanide is used as a means of introducing nitre-paper fumes. Potassium cyanide is used as a means of introducing hydrocyanic acid into the system for the relief of the cough of bronchitis and phthisis. In nervous dyspepsia, Dr. J. P. Crozer Griffith prescribes cyanide of potassium in small doses, with extract of valerian, to be taken in pill or capsule after each meal. The permanganate has been given internally, it is said, with good results in flatulent dyspepsia and lithæmia. This salt, however, soon disagrees with the stomach. Neusser has recently reported favorably upon the action of potassium tellurate in the night-sweats of phthisis. He has found that this substance, in many cases, either suppresses or considerably diminishes the sweats. Pills containing 0.02 Gm. (or gr. $^1/_3$) were given at first, but, in some instances, it was necessary to double the dose after they had been in use for about a week. No toxic symptoms were ever manifested; the appetite sometimes seemed to be improved by the drug. It communicates a strong odor, resembling garlic, to the breath of the patient. The therapeutic action of potassium bromide is discussed under **Bromine.**

Potassium Chlorate is extravagantly praised by some and neglected almost entirely by others. It has been shown that, administered in 1 Gm. (or gr. xv) doses three times a day, it is serviceable in preventing disease of the placenta, and thus enabling a woman to go on to the end of term who had previously had several miscarriages. It appears, then, to be valuable in preventing intra-uterine death of the fœtus, if administered for four or five months in the above doses. In maternal stomatitis it is regarded by some authorities as the only remedy worth mentioning, in doses of 1 to 1.30 Gm. (or gr. xv-xx) three times a day. In the sore mouth of mercurial salivation it should be given internally and used locally as a wash, and also in the membranous and ulcerative sore mouth of children. From a review of its action it appears that persons are not equally susceptible to its effects, since

[1] *Journal of Anatomy and Physiology*, Jan., 1888; paper on the "Pharmacology of the Nitrites and of Nitroglycerin," read before Section on Therapeutics and Materia Medica. Ninth International Medical Congress, Washington, D. C., Sept., 1887.

one can take, with very little evident effect, a dose which would produce very decided symptoms in another. Hence arises a necessity for commencing with small doses, and gradually increasing to the quantity required to produce the effect. Dr. J. G. Sinclair Coghill, of Ventnor, Isle of Wight, England, contributed to the "Proceedings of the International Medical Congress," at Washington, a paper on the subject, which fairly and ably sums up the value of the drug. He found it useful in cases of deficient oxygenation of the blood, especially in placental inadequacy (as above stated); also in pulmonary insufficiency, arising from many pathological conditions interfering with the function of the lungs. He finds it a cardiac stimulant in debility of the heart, whether organic or functional, probably by improving the quality of the blood; where the blood is impoverished, as after hæmorrhages, in anæmia, chlorosis, malarial cachexia, and in convalescence after acute diseases. In chlorosis he gives the tincture of ferric chloride in an effervescing solution containing 1.62 Gm. (or gr. xxv) of potassium chlorate, thrice daily after meals. Quinine, digitalis, and nux vomica may also be used. It is best given in aërated water after food. It has decided antiseptic effects, and these are well shown when there is suppuration along the genito-urinary tract. In typhoid fever, when the skin is dry and the lips parched, Dr. R. B. Norment, of Baltimore, prescribes:—

℞ Potass. chlorat. ..... 2| Gm. or 3ss.
Spt. æther. nitrosi,
Liq. ammon. acetat. .....q. s. ad 90| c.cm. or f℥iij.
M. Sig.: A dessertspoonful every three or four hours.

The chlorate is also employed as a detergent wash, especially in the mouth and throat (8 Gm. to 473 c.cm., or 3ii-Oj), and in mercurial salivation it is particularly useful. In weaker solutions, it may be applied to unhealthy wounds, or injected into sinuses and into the bladder or rectum for local inflammation. Hæmorrhoids are often relieved by the injection into the rectum of a saturated solution of potassium chlorate combined with a few drops of laudanum. According to Unna, finely-powdered potassium chlorate is the best antiseptic dentifrice. The mouth should be thoroughly cleansed after its use.

Dillon's dentifrice is thus composed:—

℞ Pulv. potassii chloratis..... ..... 31| Gm. or ℥j.
Pulv. phenylis salicylatus (salol),
Pulv. cretæ,
Pulv. carbon ligni,
Pulv. cinchonæ..... aa 10| Gm. or 3iiss.—M.

Potassium chlorate in fine powder is advantageously dusted upon aphthous spots, in the mouths of children, also over exuberant granulations and malignant ulceration, and acts as an antiseptic and astringent. Prof. P. D. Keyser had much success in treating small epitheliomata of the eyelids by the daily application of finely-powdered potassium chlorate, and claimed that he had thus saved a resort to the use of the knife in some cases. The troches of potassium chlorate are dissolved slowly in the mouth, so as to constantly moisten the throat, and in this way they are very valuable in scarlatinal and diphtheritic sore throat.

In combination with arsenic (Fowler's solution), given internally,

potassium or sodium chlorate lozenges, locally, are of singular efficacy in clergymen's sore throat, or follicular pharyngitis.

Dr. A. Harkin regards this salt as an efficient galactagogue, having successfully used it for this purpose during many years.

In diphtheria, it should not be used in large doses on account of the depressing action of the potash upon the heart and kidneys:—

℞ Potassii chloratis (pulv.)	4	Gm. or 3j.
Acidi hydrochlorici	6	c.cm. or f3iss.
Misce et adde:—		
Tr. ferri chloridi	7.5	c.cm. or f3ij.
Aquæ q. s. ad	120	c.cm. or f3iv.

M. Sig.: A teaspoonful to be given undiluted every two hours.

Free chlorine is generated in this mixture, which is based on Watson's celebrated formula. It has been successful even where sublimate applications (1 to 500) failed to check the spread of the disease. When freely diluted with water, the above formula, or the official liquor chlori compositus, makes an excellent gargle. In the sore throat of phthisical patients we may give:—

℞ Potassii chloratis	2	60 Gm. or gr. xl.
Glycerini	15	c.cm. or f3ss.
Morphinæ hydrochlorid		10 Gm. or gr. iss.
Syrup. aurantii q. s. ad	120	c.cm. or f3iv.

M. Sig.: A teaspoonful occasionally.

Potassium chlorate will often be found beneficial, also, in chronic bronchitis, and may be serviceably combined with ipecacuanha and senega. In hæmaturia, purpura, scrofula, and many chronic affections the chlorate has been used in some cases with marked results. In many affections of the skin, especially those attended with suppuration, the author can speak with unqualified approval of the action of the chlorate. In sycosis, pustular acne, eczema pustulosum, furuncles, and carbuncles the suppurative stage is decidedly abridged. It exerts a tonic influence in scrofula, and is peculiarly appropriate in the case of debilitated subjects of syphilis. Potassium chlorate, as a rule, should be prescribed alone, and not in combination with other agents, which may decompose it.

J. N. Roussel, of New Orleans, reports[1] a remarkable success in a case of leprosy, which was treated with potassium chlorate. The patient, a man of 50 years of age, had tubercular leprosy. At the end of one year's treatment the lesions had disappeared and sensation had returned.

Oxalate of potassium has been used by Cavazzani, in 1-per-cent. solution for hypodermic injection in the treatment of phlegmon and milk-leg, with asserted very encouraging results.

Potassium Dithiocarbonate.—This compound is obtained by the action of carbon disulphide on potash lye at the boiling temperature. It occurs in the form of a crystalline powder, deliquescent, of an orange-red color, very soluble in water and but slightly soluble in alcohol. Made into an ointment of 5-, 10-, or 20-per-cent. strength, it has been used, with reported good results, in various diseases of the skin. The stronger preparations may prove irritant.

Potassium iodide is discussed with other iodides under **Iodum.**

[1] *Journal of the American Medical Association*, June 13, 1903, p. 1635.

PRINOS.—The black alder, Prinos verticillatus (Aquifoliaceæ), or winter-berry, is an indigenous shrub, or small tree, bearing clusters of bright-red berries. The bark, which was formerly official, contains resin, tannin, and some bitter principle not yet isolated.

Physiological Action.—It is astringent, tonic, and alterative.

Therapy.—Prinos is administered in the form of fluid extract, or a decoction, in gastric disorder and diarrhœa. Antiperiodic virtues have been attributed to this drug. It is also used internally, as an application in skin diseases, and as a topical application to indolent and unhealthy ulcers. Dose of the fluid extract, 1.20 to 2 c.cm. (or *m*xx-xxx).

PROTARGOL is a silver albumose, said to contain 8.3 per cent. of metallic silver. It is a yellow powder, freely soluble in water. It is said to be less irritating than silver nitrate and does not discolor the skin.

It has been used especially in the treatment of purulent affections of the conjunctivæ, the lacrymal duct and sac. Instillations of solutions varying from 1 to 3 per cent. are recommended in conjunctival catarrh. It is especially destructive to the gonococcus. In gonorrhœal ophthalmia, Dr. Edward S. Peck, of New York City, and others have reported that the duration of the disease is shortened and gonococci have disappeared earlier than by other treatment. It has also been employed in place of silver nitrate in Credé's treatment. Solutions should be kept in amber-colored bottles. Dr. William L. Richardson, of the Lying-in Hospital, Boston, used protargol (2 per cent.) in every baby's eyes at birth, for three months. None of the redness and swelling of the lids and none of the temporary secretion that immediately follows the use of nitrate of silver (1 per cent.) was observed. Cheney[1] used protargol in a 2-or 4-per-cent. solution in the treatment of ophthalmia neonatorum, in comparison with solution of nitrate of silver (1 to 2 per cent.). The less degree of irritation from the former was very noticeable; there was also less tendency to lacrymation and to the formation of fibrinous coagulate and false membranes in the protargol eyes. It has been used with success in 5-per-cent. solution in empyema of the antrum maxillare. Also in the treatment of gonorrhœa in all stages. A 20-per-cent. solution has been recommended to prevent gonorrhœa, a few drops being injected into the urethra. In chronic ulcer, protargol may be used as a dusting powder.

Protargol can be prescribed with the ordinary pill basis. The maximum daily dose is 0.65 Gm. (or gr. x). It greatly relieved the symptoms in a case of advanced carcinoma of the stomach. It was found useful in chronic diarrhœa and in ulcer of the intestines. In hæmatemesis from gastric ulcer its effect was said to be excellent, given in powder (0.50 Gm., or gr. viiss). One case of locomotor ataxia was greatly benefited, 0.20 Gm. (or gr. iij) being given three times daily for nine months. (See also **Largin** for comparison.)

PRUNUM (U. S. P., B. P.).—**Prune.**

Preparation.

Confectio Sennæ (U. S. P., B. P.).—Confection of Senna. Dose, 4 to 8 Gm. (or 3i-ij).

[1] *Boston Medical and Surgical Journal*, 1898.

Pharmacology.—"The partially dried, ripe fruit of prunus domestica" (Rosaceæ). The prune-tree is cultivated as an article of food in all temperate climates. The dried fruit is official. The French prunes are considered the best; they should be large, sound, and not too dry. Very fine fruit can now be obtained from California. As stewed fruit, they are used as a relish upon the table, and are generally liked. The cooked fruit is laxative, and is given to women after confinement, and to children. They may be made cathartic by the addition of senna or podophyllum, forming "medicated prunes."

PRUNUS VIRGINIANA (U. S. P.).—Wild Cherry.

PRUNI VIRGINIANÆ CORTEX (B. P.).—Virginian Prune-bark.

Preparations.

Fluidextractum Pruni Virginianæ (U. S. P.).—Fluid Extract of Wild Cherry. Dose, 0.60 to 4 c.cm. (or *m*x-f3j).

Infusum Pruni Virginianæ (U. S. P.).—Infusion of Wild Cherry (4 per cent.). Dose, 30 to 120 c.cm. (or f℥i-iv).

Syrupus Pruni Virginianæ (U. S. P., B. P.).—Syrup of Wild Cherry, Syrup of Virginian Prune (15 per cent., made by percolation, without heat). Dose, 4 to 15 c.cm. (or f3i-iv). B. P., 2 to 4 c.cm (or f3ss-j).

Tinctura Pruni Virginianæ (B. P.).—Tincture of Virginian Prune (20 per cent.). Dose, 2 to 4 c.cm. (or f℥ss-j).

The National Formulary has a wine and also a ferrated wine of wild cherry.

Pharmacology.—"The dried bark of the Prunus serotina (Rosaceæ), collected in autumn," has an aromatic, astringent, bitterish taste, and on maceration in water has the characteristic odor of hydrocyanic acid. This is developed by the presence of water, as the bark contains amygdalin and emulsin, which form hydrocyanic acid and an oil like the oil of bitter almond. Amygdalin is a crystallizable glucoside, bitter to the taste, soluble in water and alcohol, but insoluble in ether. Emulsin is an albuminous substance, which dissolves in water, and is coagulated by heat, acids, and alcohol. Glycerin aids in keeping the dissolved matters in permanent solution, and is therefore added to both the fluid extract and the syrup. The former more fully represents the drug than the latter, since the tannin is soluble in the dilute alcohol, but not in water. The infusion and syrup, therefore, are less astringent than the fluid extract. A wine of wild cherry may be made by extracting the medicinal principles from the bark, or by the addition of 2 parts of the fluid extract of wild cherry to 8 parts of sherry-wine. Dose, 4 to 15 c.cm. (or f3i-f℥ss). The wine of wild cherry (N. F.) is made directly from the bark, the menstruum being dilute alcohol and Angelica wine. Each 4 cc. (3j) equals 1 Gm. (or gr. xv) of wild cherry.

Physiological Action.—Wild cherry is astringent, tonic, and sedative. Its pleasant flavor has made the syrup a popular vehicle for cough remedies. It increases appetite and promotes digestion, reduces expectoration and cough, and diminishes nervous irritability.

Therapy.—As a tonic, the infusion is very serviceable in phthisis, where it also lessens the cough and expectoration, strengthens the digestive function, and reduces fever. In the cough of phthisis, we get good results from the following combination:—

℞ Codeinæ phosphatis	13	Gm. or gr. ij.
Tr. belladonnæ folior.	5	c.cm. or f℥ij.
Syr. pruni Virg. q. s. ad	90	c.cm. or f℥iij.

M. Sig.: A teaspoonful, or two, when cough is troublesome at night.

Wild cherry allays nervous or reflex cough, and may very appropriately serve as a vehicle for more potent remedies in whooping-cough. Palpitation of the heart, whether purely nervous or of dyspeptic origin, is benefited by the administration of this drug. Cases have been reported by Dr. Clifford Allbutt in which wild cherry was of service in mitral insufficiency, and in dilatation of the heart with chronic bronchitis and dyspnœa. In nervous debility, insomnia, and poor digestion, small doses of the fluid extract are useful as a stomachic, taken before meals. In such cases, also, the (N. F.) ferrated wine of wild cherry, containing tincture of ferric citrochloride (N. F.) in wine of wild cherry (N. F.) (85 c.cm. to 1000 c.cm.); also the fluid extract of wild cherry, 10 per cent., will be found good general tonics in doses of a drachm or two several times a day.

PTELEA CORTEX.—Ptelea-bark, Hop-tree Bark. The Ptelea trifoliata (Rutaceæ), a tree of North America, affords, in the bark of the root, an appetizing tonic, occasionally useful during convalescence in dyspepsia, etc. It is best given in fluid extract; dose, 0.50 to 2 c.cm. (or *m*viii-xxx).

PTEROCARPI LIGNUM (B. P.).—**Red Sanders Wood (Red Sandalwood.)** (See **Santalum Rubrum**, U. S. P.)

PULSATILLA.—Pulsatilla, Meadow-anemone.

Dose, 0.065 or 0.32 Gm. (or gr. i-v), in fluid extract, or tincture.

Pharmacology.—This comprises "the herb of Anemone Pulsatilla and Anemone pratensis (Ranunculaceæ), collected soon after flowering," carefully preserved and kept not longer than one year. Pulsatilla contains an acrid, camphoraceous principle, which readily breaks up into **Anemonin** and **Anemonic acid.** The active principle being volatile, the herb must be fresh or, at least, not kept longer than a year. The best preparation is a fresh alcoholic extract.

Anemonin occurs as white needles, slightly soluble in water and ether, readily soluble in hot alcohol and hydrochloric acid. Anemonin may be given in doses from 0.006 to 0.03 Gm. (or gr. $^1/_{10}$ to $^1/_2$).

Physiological Action.—The recent plant has some irritant properties, the juice causing numbness, tingling, and inflammation of the part to which it is applied. Internally, it lowers the pulse-rate and temperature in the inferior animals, and stupor and convulsions have been produced by large doses. In considerable quantity in the human subject it causes nausea and vomiting. In poisonous doses death results from respiratory failure and convulsions.

Therapy. — Pulsatilla is reported to be adapted to the treatment of acute catarrh of the respiratory passages unattended by gastro-intestinal disorder. Borchain praises its action in acute epididymitis, given in doses of 0.06 to 0.13 c.cm. (or *m*i-ij) of the tincture every two hours. Shapter has found it useful in hysterical convulsions and reflex spasms due to uterine disease Phillips states that he has seen pulsatilla do good in mental disorders, and in sudden suppression of the menses, or lochia. Anemonin is said to be of

avail in pertussis and irritative coughs. According to Dr. Bovet, it has a decided sedative action in dysmenorrhœa and other painful affections of the female pelvic organs. He prefers a recent extract, on the ground that the active principle is volatile. Anemonin has been likewise used with alleged success in asthma and epididymitis.

It has been also used by hypodermic injection as an antipyretic. Dose, 0.3 Gm. (or gr. iv). Used by L. Byk[1] in typhoid fever and in erysipelas, scarlatina, etc.

PYRAMIDON, or **Dimethyl Amidophenyl-Dimethyl Pyrazolon**, is a derivative of antipyrin, which it resembles in its action, but is considered milder and safer. It has been used as an antineuralgic and as an antipyretic in doses of 0.2 to 0.6 Gm. (or gr. iij-x). In tabes it has been given up to 3.0 Gm .(or gr. xlv) per diem. In consumption, the dose should not exceed 0.5 Gm. (or gr. viiss) for the relief of hectic.

PYRETHRUM (U. S. P.).—**Pellitory.**

PYRETHRI RADIX (B. P.).—**Pyrethrum-root.**

Preparation.

Tinctura Pyrethri (U. S. P., B. P.).—Tincture of Pellitory (20 per cent.).

Pharmacology and Physiological Action.—"The dried root of Anacyclus Pyrethrum" (Compositæ), a small plant of Africa, cultivated in Europe, contains an alkaloid, **Pyrethrine**, an acrid resin, a volatile oil, tannic acid, starch, mucilage, etc. Pyrethrum has an acrid taste, and causes a free flow of saliva (sialagogue), with a prickling, pungent effect upon the tongue when chewed. If swallowed in considerable doses, it causes diarrhœa and tenesmus and dysenteric or bloody stools, with depression and stupor. The powdered root is irritating to the skin and causes sneezing when inhaled into the nostrils.

Therapy.—In neuralgic, rheumatic, and other painful affections of the tongue or teeth, pellitory may be chewed or held in the mouth. Pellitory-root is sometimes used as a masticatory in paralysis of the tongue, and may be employed in order to stimulate the salivary glands when their secretion is deficient. Dr. Whitla finds that the sialagogic action of pellitory constitutes an excellent means for the removal of iodine from the system. A few drops of the tincture may be introduced into hollow, aching teeth; or, diluted with water, it may be used as a stimulating mouth-wash or gargle in scorbutus and sore throat, with relaxed mucous membrane.

Pyrethri Flores is derived from another species, the **Pyrethrum roseum**, or more properly, the Chrysanthemum roseum, growing in Asia, of which the half-expanded flower-heads are very destructive to insect life. Under the name of insect powder, or **pulvis insecticidus**, the powdered flowers are largely used to kill insects. If a small quantity is placed upon a plate and wet with alcohol and ignited, the fumes will kill or drive from the room small insects, like flies or mosquitoes. It is also used in household economy, and in furniture to destroy chink-bugs, and to remove fleas from dogs. The Dalmatian powder is the best; the Persian, or Caucasian, is less

[1] *Deutsch. Med. Woch.*, Jan. 15, 1903.

effective. Schlagdenhauffen and Reeb have discovered in these flowers an active principle, which they name **Pyrethrotoxic acid.** When hypodermically injected into animals, it causes at first excitement, soon followed by complete prostration and paralysis of lower extremities, and death by failure of respiration and circulation. To cheapen the cost of the powder, many dealers adulterate it with inert vegetable matter.

PYRIDINUM.—Pyridine (C_5H_5N) is a clear, colorless, volatile liquid, with characteristic odor and pungent taste. Pyridine is soluble in water and alcohol, and forms crystalline salts, which are likewise soluble in those fluids. In aqueous solution it has a marked alkaline reaction. It boils at 116° C. (240.8° F.), and is miscible with water, oil, alcohol, ether, and benzin, forming clear solutions. It gives precipitates with solutions of most metals, but not with lead acetate and magnesium sulphate. Pyridine is the foundation of a group of compounds known as pyridine bases, formed in the dry distillation of bones and other nitrogenous compounds, and as a decomposition product of nicotine and some other alkaloids. It was discovered in 1846 by Anderson. Chapman and Smith have made it by synthesis, by dehydrating amyl nitrite with phosphoric anhydride. Nascent hydrogen converts pyridine into piperidine.

Physiological Action.—Upon the healthy adult inhalations of the vapors of pyridine mixed with air produce flushing of the face, with quickening of the pulse and of the respiration, the latter lasting only a few moments, the former from fifteen minutes to ten hours, depending upon the amount inhaled. Pyridine produces slight giddiness and sometimes headaches. According to Cantani, pyridine exerts a markedly deleterious influence upon the medulla and particularly upon the respiratory and cardiac centres. It diminishes reflex irritability and causes a fall of blood-pressure. In large doses pyridine causes a fall of temperature, cyanosis, paralysis, and death from respiratory failure. It occasions the formation of methæmoglobin in the blood.

In asthmatic patients, the quickening of the respiration is not observed; on the contrary, the heart's action slowly falls to the normal, if it had been previously accelerated, without change in rhythm or force, while the respiration becomes slower, easier, and fuller, the dyspnœa disappearing. In most cases there is a desire to sleep, without narcotism or interference with brain functions, the patient being easily wakened, as out of natural sleep. The odor of the drug is soon recognized in the urine, and it is expelled by the kidneys and in part by the lungs. Its elimination by the urine is remarkably rapid. Pyridine is also possessed of some antiseptic priperties.

Therapy.—From the fact that tobacco-smoke, when inhaled, gives relief in asthma, Germain Seé was led to attribute the effect to pyridine, and from clinical experience, in a woman suffering with asthma and dyspnœa from heart disease, he was induced to advocate its further employment. From 4 to 7.50 c.cm. (or f3i-ij) were poured upon a plate, and the fumes inhaled by the patient with her head directly over it. These inhalations were continued from twenty to thirty minutes, and were found to afford much relief, and frequently to abort or arrest the dyspnœic attack. In a number of other cases, including some both of pure asthma and of cardiac asthma, this treatment was resorted to with remarkably good results. Sée believed that pyridine is the most certain agent for bringing relief when iodine fails, and that

it is superior to the hypodermic use of morphine, its action being more lasting and better borne by the system. Dr. Neff also reported good results. Of 12 cases, 3 were of nervous asthma, with complete relief and no return of the attack; 3 cases of cardiac asthma were relieved; 3 of bronchial asthma had no return of attack; of 2 cases of dyspnœa in advanced phthisis, 1 was slightly relieved, the other was not benefited; 1 case of asthma, as complication of gout, was cured. All unpleasant symptoms were confined to cases with long-standing emphysema, or valvular or degenerative heart disease, with small, irregular pulse. In advanced phthisis, it should be used with care, and probably will fail. Pyridine has given relief in angina pectoris. Cerna writes that it has been given internally in doses of 0.12 to 0.18 c.cm. (or *m*ii-iij) and as an injection with 300 parts of water in gonorrhœa. A decided drawback to the use of this remedy is its extremely disagreeable odor.

PYROGALLOL (U. S. P.).—**Pyrogallol, Pyrogallic Acid** [$C_6H_3(OH)_3$].

Pharmacology.—Pyrogallol is a triatomic phenol obtained chiefly by carefully heating gallic acid (U. S. P.). It occurs in the form of brilliant white crystals, of a bitter taste and free from odor. It should be kept in amber-colored bottles, as the crystals darken on exposure to light. Pyrogallol is soluble in water, alcohol, and ether. Its watery solution, in contact with the air, absorbs oxygen and acquires a brown color, and the fluid changes from a neutral to an acid reaction. The alteration takes place more rapidly if a caustic alkali be present. Pyrogallol may be used dissolved in flexible collodion, 0.65 to 2.60 Gm. to 30 c.cm. (or gr. x-xl to f℥j), or as an ointment with petrolatum (5 to 15 per cent.).

Dr. Kromayer, in a paper read before the Sixth Congress of the German Dermatological Society, called attention to some new reactive remedies, in a paper which stated that pyrogallol is a benzin with three hydroxyl groups, each of which may be replaced by acid radicles. Thus, we may have a monoacetyl-pyrogallol, a diacetyl-pyrogallol, and a triacetyl-pyrogallol. Pyrogallol monoacetate, or "**Eugallol,**" is a syrupy, dark-yellow liquid, soluble in water; parogallol diacetate is a white powder not readily soluble in cold water; pyrogallol triacetate, or "**Lenigallol,**" is a white powder entirely insoluble in water, and is only gradually dissolved on warming, with aqueous solutions of alkalies, with decomposition. Lenigallol is a mild preparation, even ointments containing 50 per cent. with wool-fat causing no irritation, when applied under a bandage. It is decomposed by the strongly alkaline perspiration, producing the characteristic darkening of pyrogallol, together with its action on the skin, in cases of psoriasis, chronic eczema, and in chronic impetiginous eruptions. It is asserted that lenigallol is non-poisonous.

Physiological Action and Therapy.—When applied to the skin, pyrogallol causes a brown discoloration. The incautious application of pyrogallol may cause inflammation of the skin, and this may result in extensive ulceration and sloughing. It will also stain the hair and nails as well as linen apparel with which it comes in contact. If absorbed in sufficient quantity this substance excites vomiting, diarrhœa, disturbances of temperature, nervous manifestations and great prostration of muscular strength. Fatal cases have occurred from the free use of an ointment on large cutaneous lesions. The urine is black and contains hæmoglobin, and the blood becomes of a blackish or chocolate color. In dogs poisoned by pyrogallol, hepatic lesions

were produced identical with those caused by phosphorus. The mineral acids act as antidotes. Pyrogallol possesses antiseptic properties.

Pyrogallol is employed as an external application in certain diseases of the skin. It has a good effect upon the patches of psoriasis, and may be applied as an ointment or dissolved either in flexible collodion or in alcohol with the addition of a little glycerin. Used in a similar manner, pyrogallol is serviceable in lupus, lepra, and syphilitic lesions of the integument. **Eugallol** has been used in place of pyrogallol for local treatment in psoriasis. It is applied pure, followed in half an hour with zinc oxide powder or paste.

Gallacetophenone.—This substance, a derivative of pyrogallol, was discovered by von Nencki. Gallacetophenone is obtained by heating together a mixture of 1 part of pyrogallol, 1 $^1/_2$ parts of acetic acid, and 1 $^1/_2$ parts of zinc chloride. It is a pale-yellow crystalline powder, soluble in hot water, alcohol, ether, and glycerin. The addition of sodium acetate promotes its solubility in cold water. Gallacetophenone is possessed of antiseptic properties. It has been used in 10-per-cent. solution as a substitute for pyrogallol in the treatment of psoriasis.

Pyraloxin is a derivative of pyrogallic acid. Unna found it less irritating and not toxic. It is next to chrysophanic acid in efficiency in psoriasis, and is useful in lichen planus, and lupus erythematosus. It is also a parasiticide and is used in ringworm of the scalp in children, and in sycosis after the hairs have been removed by x-rays.

PYROXYLINUM (U. S. P., B. P.).—**Pyroxylin, Soluble Gun-cotton.** A product obtained by the action of nitric and sulphuric acids on cotton, and consisting chiefly of tetranitrate [$C_{12}H_{16}(ONO_2)_4O_6$]. It should be kept in cartons protected from the light.

Gun-cotton is white, dry, and entirely soluble in a mixture of alcohol and ether. It is inflammable and violently explosive. (See **Collodion.**)

QUASSIA (U. S. P.).—**Quassia.**

QUASSIÆ LIGNUM (B. P.).—**Quassia-wood.**

Dose, 0.65 to 2 Gm. (or gr. x-xxx), in infusion.

Preparations.

Extractum Quassiæ (U. S. P.).—Extract of Quassia. Dose, 0.065 to 0.20 Gm. (or gr. i-iij).

Fluidextractum Quassiæ (U. S. P.).—Fluid Extract of Quassia. Dose, 0.30 to 1 c.cm (or *m*v-xv).

Tinctura Quassiæ (U. S. P., 20 per cent.; B. P., 10 per cent.).—Tincture of Quassia (20 per cent.). Dose, 0.65 to 4 c.cm. (or *m*x-f3j).

Liquor Quassiæ Concentratus (B. P.).—Concentrated Solution of Quassia (100 Gm. in alcohol [20 per cent.] 1100 c.cm.). Dose, 2 to 4 c.cm. (or f3ss-j).

Infusum Quassiæ (B. P.).—Infusion of Quassia (1 per cent.). Dose, 15 to 30 c.cm. (or f3ss-j).

Quassiin.—The bitter principle. Dose, 0.015 to 0.03 (or gr. $^1/_4$-$^1/_2$).

Pharmacology.—Quassia is "the wood of Picrasma excelsa" (Simarubaceæ), known commercially as Jamaica quassia, or of Quassia amara, known commercially as Surinam quassia, a large tree of the West Indies, usually occurring in the form of billets or small chips, nearly white, without odor, but very bitter. Quassia-wood contains a bitter, neutral principle, **Quassiin**, crystallizing in needles, and readily soluble in alcohol and in hot

water. According to Massutin, quassiin is a mixture of α and β picrasmin. It also has a minute quantity of **volatile oil**, but **no tannin**. The solid extract is aqueous, but the fluid extract is made with dilute alcohol.

Physiological Action.—Quassia is very destructive to flies and insects. A concentrated solution is poisonous to the lower animals, and caused serious symptoms of narcotism, in a child of 4 years, as mentioned by Potter.

In the dose of about 0.015 Gm. (or gr. $^1/_4$), Campardon found quassiin to produce severe headache, burning pain in the throat and œsophagus, sickness of stomach, vertigo, restlessness, diarrhœa, and frequent passage, but diminished secretion, of urine. In small doses it is stomachic and tonic.

Therapy.—Quassia is a simple bitter, without astringency; it is a good stomachic, and increases the appetite; it is used as a tonic in dyspepsia, where it probably exerts both a tonic and an antiseptic action. Quassia is likewise useful in diarrhœa dependent upon indigestion. It can be given with iron on account of the absence of tannic acid, and often has aromatics combined with it to improve the taste. It is useful during convalescence to stimulate the appetite, and may be combined with an alkali and given before meals. In children, an infusion of quassia is a useful agent as an enema to destroy thread-worms.

QUERCUS (U. S. P.).—White-oak Bark.

Preparation.

Fluidextractum Quercus (U. S. P.).—Fluid Extract of White Oak. Dose, 1 to 4 c.cm. (or *m*xv-3j).

Pharmacology.—"The dried bark of Quercus alba (Cupuliferæ) collected from trunks or branches 10 to 25 years of age, and deprived of the periderm," contains chiefly tannic and gallic acids, upon which its usefulness depends. The form of tannic acid contained in oak-bark is known as **Quercitannic acid.** In addition, there has been found a bitter principle, **Quercin**; also **pectin**, coloring matter, etc. There are no official preparations; but a decoction (1-16) is employed, and a fluid extract made with diluted alcohol is obtainable, but they are rarely used. Oak-galls from Quercus lusitanica also contain tannin, and, as they answer a similar purpose, they are more convenient for medical use than the bark, but tannic or gallic acid is generally used in preference.

Physiological Action and Therapy.—A decoction of white-oak bark is occasionally used as an injection or wash in leucorrhœa; also in sore throat and nasal catarrh, but it stains clothing, and may well be substituted by solutions of tannic acid. The applications of tannic acid have been already considered. The powdered bark is an ingredient in tooth-powders; it was also formerly used as an absorbent application to ulcers and as a poultice in gangrene. A confection or candy of white-oak bark is in popular use for relaxed throat.

A concentrated fluid extract of Quercus alba is, according to the method devised by Heaton, injected into the margin of the inguinal ring for the radical cure of hernia, but the forms of operative procedure for radical cure are generally preferred by surgeons.

QUILLAJA (U. S. P.).—**Quillaja, Soap-bark.**
QUILLAIÆ CORTEX (B. P.).—**Quillaia-bark (Panama Bark).**

Preparations.

Fluidextractum Quillaja (U. S. P.).—Fluid Extract of Quillaja.

Tinctura Quillajæ (U. S. P.), Tinctura Quillaiæ (B. P.).—Tincture of Quillaja (20 per cent.). (The U. S. P. formula is four times the strength of that of the B. P., of which the dose is 2 to 4 c.cm., or f3ss-j.) Dose, 0.60 to 1 c.cm. (or *m*x-xv).

Liquor Picis Carbonis (B. P.).—Solution of Coal-tar (quillaia-bark, 200 Gm.; prepared coal-tar, 200 Gm.; alcohol, 1000 c.cm.).

Pharmacology.—The "dried bark of Quillaja saponaria (Rosaceæ), deprived of the periderm," is brought to this country, from Chile, in flat pieces several inches wide and from two to three feet in length. The outer surface is brownish white, the inner whitish and smooth. It has a splintery fracture and is destitute of odor. The infusion of quillaja, when shaken, froths like soap. This property depends upon the presence of an irritant, poisonous glucoside called **Saponin,** which is now held to be a mixture of two principles known as **quillajic acid** and **quillajasapotoxin,** or **sapatoxin.** Dr. Hesse has determined that saponin derived from quillaja-bark is identical with that from other sources and with senegin, occurring as a constituent in caulophyllum, senega, and other plants. Saponin was isolated in 1850 by le Bœuf. It is a white, crystalline powder, the taste of which is at first sweet and afterward acrid. Saponin is slightly soluble in water, but more readily soluble in strong and boiling alcohol. Its saturated alcoholic solution is a solvent for gums, resins, and oils, with which, after being mixed with water, it forms permanent emulsions.

Physiological Action.—The powder of soap-bark and solutions of saponin are strongly irritant to the Schneiderian membrane and excite sneezing. In weak solutions, saponin is a local anæsthetic; in concentrated form, it is a protoplasmic poison, and its local action destroys the energy of nervous and muscular tissue. Saponin exerts a specific influence upon the alimentary tract, since even intravenous injections give rise to gastro-enteritis. Schroff found that 0.16 to 0.20 Gm. (or gr. iiss-iij) of saponin produced irritative cough and secretion of mucus in the bronchial tubes, lasting for several hours; but no effect was manifested upon either the kidneys or skin. It causes pain when injected hypodermically. Locally applied, it paralyzes both sensory and motor nerves, producing local paralysis with anæsthesia and stiffness of the muscles. It counteracts the effects of digitalis upon the heart. Saponin also paralyzes the respiratory and vasomotor centres, and after large doses respiration fails before the heart ceases to beat. If injected into a vein, death follows from cardiac paralysis, which accords with the observation that saponin reduces the force and frequency of the heart's action, and finally paralyzes it. Kobert claimed that the effects of commercial saponin are due to quillajic acid and **sapotoxin.** The quillajic acid has very active toxic properties when injected into a vein, in the lower animals. Sapotoxin has a mild taste, but is very toxic; and exercises a solvent action upon the red blood-corpuscles.

Therapy.—It is principally as a topical remedy that quillaja has been employed, but, although its range of application is limited, it exhibits decided power. Quillaja[1] is an excellent stimulant to chronic ulcers and

[1] See paper by author "On a Natural Soap and its Use in the Treatment of Diseases of the Skin," *The Medical Bulletin,* July, 1879.

chronic eczema, the affected parts being covered by a roller-bandage which has been saturated in an infusion of soap-bark. The same preparation is of value in hyperidrosis and bromidrosis. The hands and feet may be advantageously bathed in this solution every day or every second day, while the axillæ or face can be mopped by a sponge which has been dipped in the infusion. In dandruff and simple pityriasis, the watery solution of soap-bark is an efficient application. The tincture may be employed where more powerful action is required, as in chronic eczema or alopecia circumscripta, in which conditions it will often prove superior to the tincture of green soap. Piffard recommends a mixture of fluid extract of soap-bark with glycerin in certain forms of acne. A decoction of soap-bark is not unpleasant to the taste and has been given as an expectorant instead of senega. In aortic disease with hypertrophy, Brunton suggests the employment of quillaja for the saponin which it contains. Saponin may also be used, in small doses, as an expectorant in chronic bronchitis. Senegin, which is probably identical, has been administered in 0.13 Gm. (or gr. ij) doses to check uterine hæmorrhage. Saponin might be useful in affections for which senega has been recommended, as snake-root is thought to owe its activity to this active principle.

The root of Saponaria officinalis (not official), a perennial herb, common around dwellings, known as soapwort or "Bouncing Bet," contains about 30 per cent. of saponin in the inner bark. The soapwort has been used in the form of a decoction, as an alterative in chronic skin diseases, scrofula, and gonorrhœa.

QUININA. (See **Cinchona.**)

RADIUM. (See Part III.)

RANUNCULUS.—Crowfoot or Buttercup.—None of the 250 species of **Crowfoot** is official. Sir James Sawyer, of Birmingham, recommends[1] an ointment of the fresh herb of Ranunculus Ficaria in lard (1 to 4) in the treatment of piles. By the addition of spermaceti (25 per cent.) suppositories may be made with this ointment.

RESINA (U. S. P., B. P.).—**Resin, or Rosin (Colophony).**

Preparations.

Ceratum Resinæ (U. S. P.).—Resin Cerate, Basilicon Ointment (resin, 35; yellow wax, 15; lard, 50 parts).

Ceratum Resinæ Compositum (U. S. P.).—Compound Rosin Cerate (rosin, 22½; yellow wax, 22½; suet, 30; turpentine, 11½; and linseed oil, 13½ parts).

Unguentum Resinæ (B. P.).—Resin Ointment (resin, 20 Gm.; yellow bees-wax, 20 Gm.; olive-oil, 20 Gm.; lard, 15 Gm.).

Linimentum Terebinthinæ (U. S. P., B. P.).—Turpentine Liniment (resin cerate, 65; oil of turpentine, 35 parts). The Liniment of Turpentine of the B. P. does not contain resin.

Emplastrum Resinæ (B. P.).—Resin Plaster (hard soap, 5; rosin, 10; lead plaster, 80 parts).

Pharmacology.—Resin is "the residue left after distilling off the vola-

[1] *British Medical Journal*, January 2, 1904.

tile oil from turpentine" (U. S. P.); "the residue left after the distillation of the oil of turpentine from the crude oleoresin (turpentine) of various species of Pinus (B. P.)." (See **Terebinthina.**) It enters into several official cerates and plasters, to which it gives adhesiveness. Resin is insoluble in water, but soluble in alcohol, ether, fixed and volatile oils.

Physiological Action.—It is slightly irritating to the skin, and internally is antiseptic and astringent in its effects upon the intestines.

Therapy.—Resin has been employed as a domestic remedy for diarrhœa, a few grains, finely powdered, being given every hour or two, but it is seldom used internally. The fumes coming from boiling resin may be inhaled in chronic bronchitis and in winter cough. Resin cerate, or basilicon ointment as it is sometimes called, is a popular dressing for ulcers, promoting cicatrization and granulation. Compound resin cerate, or Deshler's salve, as it is popularly called, contains turpentine, and is more stimulating than the plain cerate; it is sometimes applied to blisters to prevent their healing too quickly and to promote suppuration. It keeps better if made with petrolatum than with linseed oil, as in the official formula. The latter should be freshly made.

Retinol, or Resinol (Codol), is a liquid hydrocarbon, obtained by the dry distillation of colophony, or of Burgundy pitch. It is of a brown or yellowish color, has the consistency of a fat, and has a slightly bitter taste; its reaction is slightly acid on account of the presence of traces of picric acid. It forms a varnish-like coating over a surface when applied. It shares the antiseptic properties of the other balsams, and possesses the additional advantage of dissolving a great number of active substances, such as oil of cade, camphor, beta naphthol, balsam of Peru, phosphorus, iodol, salicylate of phenyl, chrysarobin, cocaine, etc. Retinol mixes with fats, oils, wool-fat, glycerin, and petrolatum. By mixing a proper proportion of colophony with oak-leaves or sodium borate, a mass can be obtained sufficiently adhesive to allow it to be made into suppositories for vaginitis, etc.[1] Retinol is non-irritating when applied to the skin, and is an excellent vehicle for medicaments in cutaneous diseases. It does not become rancid and is unchangeable by time or light. It has an advantage of most of the new remedies in the fact that the price is moderate.

Therapy.—M. Barbier gives a number of formulæ for its use, from which the following are taken:—

℞ Retinol.	10	Gm. or 3iiss.
Adipis lanæ hyd.	5	Gm. or 3i gr. xv.
Sodii bicarbonatis	13	Gm. or gr. ij.

M. et ft. unguentum.

This is used in the ophthalmological clinic of Dr. Hubert for conjunctivitis, simple or gonorrhœal affections of the lids or the tear-ducts, and for the preparation of dressings and protection of instruments. The following, of greater consistence, may be ordered:—

℞ Retinol., Resinæ, Adipis lanæ hyd. aa	8	Gm. or 3ij.

M. et ft. unguentum.

[1] Drs. Balzar and Chevalet, *La Médecine Moderne*, April 24, 1890.

Retinol is antiseptic, unirritating, and, in a large number of skin diseases, it gives excellent results, either alone or as an antiseptic excipient for other substances.

In some skin affections, the following may be used with advantage:—

℞ Retinol.	8	Gm. or 3ij.
Glycerit. amyli	11	c.cm. or f3iij.

M. Sig.: For external application as directed.

Or this:—

℞ Retinol.	15	5 Gm. or 3iv.
Ol. cadini	15	c.cm. or f3iv.

M. Sig.: For psoriasis, chronic eczema, etc.

M. Vigier[1] states that retinol gives excellent results, in the proportion of 6 per cent., in vaginitis and in blennorrhœa, as a topical application. The effects of this mixture are beneficial also in chronic cystitis, but in acute cases it often acts as an irritant. Desnos reports very favorably of the use of a 5- to 10-per-cent. solution of salol in retinol in the treatment of subacute cystitis. The solution is injected into the bladder where it is allowed to remain, exerting a local influence, for a number of hours.

RESORCINOL (U. S. P.).—**Resorcin, or Resorcinol** [$C_6H_4(OH)_2$].

Dose, 0.65-1 to 3 Gm. (or gr. x-xv to xlv).

Pharmacology.—Resorcin is a diatomic phenol, made by fusing gum-resins with caustic potash. The process for obtaining it from gum-ammoniac has already been described. It is now prepared from benzene, on a large scale, synthetically. It crystallizes in small, colorless prisms or plates, has a neutral reaction, a sweetish taste, with slight pungency or acidity, and an odor which resembles that of carbolic acid. Resorcin melts at 246.2° F. and distills at 529.7° F. It was discovered by Hlasiwetz and Barth. It should be kept in dark, amber-colored vials.

Resorcin is an oxyphenol, homologous with orcin, derived from benzol by the substitution of two hydroxyl groups for two atoms of hydrogen. Chemically, it is a dihydroxybenzene, of which there are three forms, namely: ortho-, meta-, and para-, the first is known as pyrocatechin or catechol; the second as resorcinol; and the third as hydroquinol. Resorcin, when exposed to light and air, acquires a yellow-brown or reddish-pink color. It is soluble in water and other solvents, except chloroform and carbon disulphide. The best vehicles for medicinal purposes are alcohol, glycerin, and syrup of orange. While the dose is usually from 0.32 to 1 Gm. (or gr. v-xv) 4 Gm. (or 5j) may be given at a single dose, as an antipyretic. It is a most efficient antiseptic and antiferment. Andeer recommends fresh butter as a vehicle for making an ointment (1 per cent.) extemporaneously.

Resorcin may be tested by dissolving it in a solution of potassium hydroxide, adding a drop of chloroform: the mixture, being heated, will assume an intense crimson color. If a slight excess of hydrochloric acid be then added, the color will change to a pale straw yellow.

Physiological Action.—Resorcin is non-irritant to the skin, and, when injected subcutaneously, causes very little inflammation and no suppuration.

[1] "Du Retinol et de son Emploi en Médecine," par F. Vigier. *Journal de Médecine de Paris*, Nov., 1890, p. 641.

In strong solutions it irritates mucous membranes and sometimes vesicates them. In full doses (2 to 4 Gm., or gr. xxx-3j) resorcin acts as an antipyretic, reducing the temperature for two or three hours, but at the same time has the disadvantage of causing nausea, oppression, languor, and free perspiration. Above these amounts it is not safe to go, since, by larger doses, cerebral symptoms are induced, such as deafness, vertigo, confusion of vision, convulsions (clonic and tonic), and rigidity of the muscles of the back of the neck. Death has, in several instances, been caused in children by washing out the stomach with a 3-per-cent. solution of resorcin; in one case hæmoglobinuria was produced. In lower animals, death occurs from failure of respiration and paralysis of motor tracts in the spinal cord. It is excreted chiefly by the urine, which it darkens or even changes to a bluish color; the addition of tincture of ferric chloride to such urine causes it to become a dark-violet color. Symptoms of poisoning in man are best treated by free catharsis, diffusible stimulants, hot drinks, and diuretics; atropine and strychnine might be given hypodermically.

Therapy.—The decided antiseptic qualities of resorcin, with its solubility and not unpleasant odor or taste, make it a valuable application for the throat and nose in diphtheria[1]; and in this disease it may also be administered internally to disinfect the gastro-intestinal tract, and thus prevent reinfection. It is considered also to be of service to impregnate the atmosphere of the sick-chamber by the spray from a steam atomizer, of a 5-per-cent. solution of the same agent. In erysipelas, puerperal fever, and septicæmia, resorcin has been used, both locally and internally, with marked benefit. A 2-per-cent. solution is a good spray for various catarrhal and other affections. In saturated ethereal solution, resorcin acts as a slight caustic, especially to raw surfaces or mucous membranes. The powder may be dusted on granulations, pure or combined with boric acid (1 to 20 or 1 to 10); it is very efficient in discharges from the ear. The ear should be thoroughly cleansed with a solution of boric or carbolic acid, and dried; after this the above powder can be blown into the canal. To foul ulcers and sloughing wounds an ointment containing 4 to 8 Gm. (or 3i-ij) of resorcin in each 31 Gm. (or ℥j) is an excellent application. Chancroids and ulcerated syphilitic lesions receive decided benefit from the same preparation. A concentrated alcoholic solution of resorcin is an efficacious local application to leukoplakia. A 1- or 2-per-cent. watery solution of resorcin is of service in acute or chronic conjunctivitis and wounds of the cornea. It is likewise a beneficial application to tuberculosis of the larynx, to mercurial and other forms of stomatitis, and to thrush. In whooping-cough and hay fever this remedy is advantageously used in the form of a spray, a 2-per-cent. solution being efficacious in the former disease, while in hay fever the solution has been made as strong as 20 per cent. Moncorvo, who introduced this method of treating whooping-cough, is accustomed to use a solution of chemically-pure resorcin in sterilized water and apply it to the laryngeal mucous membrane by means of a thick brush of camel's hair attached to a handle of flexible iron wire. Applications are made every two or three hours during the day. Resorcin ointment has been employed with good effect in certain diseases of the skin, as chronic eczema, psoriasis, alopecia circumscripta, and lupus erythematosus. In the abortive treatment of herpes, M. Leloir employs the following solutions (*Medical News*):—

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[1] "Resorcin in Diphtheria," *Centralblatt für die gesammte Therapie*, H. 9, 1890.

℞ Resorcinolis	2		Gm. or 3ss.
Cocain. hydrochloridi	50 to 2		Gm. or gr. viii vel xxx.
Acidi tannici	6		Gm. or 3iss.
Alcohol. (90 per cent.)	90		c.cm. or f℥iij.—M.

Or:—

℞ Cocain. hydrochloridi	1		Gm. or gr. xv.
Ext. cannabis Indicæ	10		Gm. or 3iiss.
Spt. menth. pip.	9	25	c.cm. or f3iiss.
Alcohol. (90 per cent.)	60		c.cm. or f℥ij.—M.

M. et ft. sol.

Petrini obtained good results in acne rosacea, after the pustules had been opened, by the application of the following preparation:—

℞ Resorcinolis	1		Gm. or gr. xv.
Ichthyolis	2		c.cm. or f3ss.
Collodii flexil.	30		c.cm. or f℥j.—M.

Resorcin-soap (5 or 10 per cent.) as first used by Julius Andeer, has been found useful in ringworm of the scalp and other parasitic skin diseases. According to the observation of Dr. Jamieson, a resorcin-salicylic superfatted soap shortens the desquamative stage of scarlatina. In a series of cases, washing the skin with this soap and warm water reduced the period of desquamation by two weeks. For seborrhœic eczema, Dr. Eddowes recommends:—

℞ Resorcinolis	2	to 4		Gm. or 3ss-3j.
Glycerini	60 to 1		20	c.cm. or *m*x-xx.
Acet. cantharid.	11			c.cm. or f3iij.
Ol. amygdalæ dulcis	15			c.cm. or f3iv.
Sp. odoratis	30			c.cm. or f℥j.
Alcoholis	90	to 150		c.cm. or f℥iii-v.
Aquæ	q. s. ad 240			c.cm. or f℥viij.

M. This forms a pleasant local application and relieves itching.

In the treatment of extensive patches of tinea versicolor, Dr. E. Bodin employs an ointment thus composed:—

℞ Resorcinolis			
Acidi salicylici	aa 1		Gm. or gr. xv.
Sulphur. precip.	5		Gm. or gr. lxxv.
Adipis lanæ hyd.			
Petrolati mollis,			
Sevi.	aa 23	3	Gm. or 3vj.

M. et ft. ungt.

Resorcin is a better antiseptic than carbolic acid for internal administration, and can be given as an antiferment in dyspepsia and digestive disorders. In gastric catarrh, gastralgia, and ulcer of the stomach, resorcin has rendered good service. It may be likewise used with success to allay nausea and vomiting and has been given with asserted advantage in seasickness. In gastric ulcer, it relieves pain and checks hæmorrhage.

Prof. W. H. Thomson, of New York, has prescribed it in this class of cases as follows:—

℞ Resorcinolis.		8|	Gm. or 3ij.
Tr. aurant. cort.,			
Glycerini,			
Syr. zingib.	aa	15|	c.cm. or fʒss.
Aq. menth. pip.	q. s. ad	180|	c.cm. or fʒvj.

M. et ft. sol.
Sig.: Two teaspoonfuls in wineglassful of water after meals.

Resorcin is also serviceable in the diarrhœa of children. A solution has been successfully employed as an injection in gonorrhœa and for washing out the bladder, there being but little danger in these cases from absorption of the remedy. In epithelioma of the skin, resorcin has given excellent results in the hands of Dr. Mario Luciani, who reports two cases of cutaneous epithelioma in which he claims to have effected a complete cure by the application of an ointment containing resorcin. He used this formula:—

℞ Resorcinolis		10|	Gm. or 3iiss.
Petrolati		31|	Gm. or ʒj.

M. Sig.: Apply once a day to the ulcerated surface, after previously cleansing with a 2-per-cent. watery solution of borax.

One case, a woman of 48 years, with an ulcer upon her forehead, was cured in three months; and in another, 60 years of age, with the same disease upon her lip of about a year's duration, this simple treatment was followed by an equally happy result. No microscopical examination appears to have been made in either case in order to establish the diagnosis (*Journal of the American Medical Association*). In doses of 0.65 to 1.62 Gm. (or gr. x-xxv), resorcin is claimed to have reduced the pyrexia of tuberculosis.

Resopyrin.—This compound is prepared by precipitating antipyrin with a molecular proportion of resorcin. The substance is insoluble in water and crystallizes from alcohol in colorless, rhombic crystals.

Eucalypto-resorcin.—A combination has been made by M. Barbey by placing eucalyptol in contact with resorcin, in excess. This body is insoluble in chloroform, from which it is deposited in the form of interlacing crystals. The crystals are insoluble in water, very soluble in alcohol and ether, volatilize at 100 degrees, giving off a strong odor of camphor.

Iodoform-resorcin.—Dr. Bielaiew vaunts a combination, which he terms resorcinol, composed of equal parts of resorcin and iodoform. This is an amorphous, yellowish-brown powder, having an odor resembling that of iodine. It has been used upon leg-ulcers, unhealthy wounds, and syphilitic lesions. Resorcinol has been employed in the form of a powder, weakened with 4 parts of starch, or as an ointment in the strength of 2 to 4 Gm. (or ʒss-j) to 31 Gm. (or ʒj) of lard. Resorcinol is, however, a bad name for this compound, since the same designation has been officially given to resorcin in reference to its phenol character.

Pheno-resorcin is a mixture of 67 parts of resorcin with 33 parts of phenol and combines the effects of these two antiseptic agents. Pheno-resorcin is soluble, forming a liquid with 10 per cent. of water, and may be used like carbolic acid.

RHAMNUS CATHARTICUS.—Common Buckthorn.

Pharmacology.—The fruit of the common buckthorn, Rhamnus catharticus (Rhamnaceæ), is decidedly cathartic and cholagogic; the bark also has these properties, and, this species being naturalized in this country, probably it is often substituted for the official frangula-bark, which is the alder buck-

thorn, an allied species of Rhamnus. (See **Frangula.**) The official Rhamnus purshiana is another variety of the same species. The fruit is purplish black, and, when dried, is about the size of a pea; the pulp contains four seeds; odor slight; taste nauseating, bitter, and acrid. The active principle is **Rhamnocathartin,** an amorphous, yellow, brittle substance. The principal preparations are: Extractum rhamni catharticæ fructus fluidum (fluid extract of buckthorn-berries); dose, 4 to 6 c.cm. (or f3i-iss). Succus rhamni catharticæ (buckthorn-juice); dose, 1 to 4 c.cm. (or *m*xv-f3j). Syrupus rhamni catharticæ (syrup of buckthorn: buckthorn-juice, with ginger, sugar, allspice, and alcohol); dose, 4 to 7.50 c.cm. (or f3i-ij).

Physiological Action. — All the species of rhamnus possess purgative properties of greater or less activity, but some are much more violent in action than others. Nausea, vomiting, and severe griping pains often attend their purgative action, to avoid which aromatics are usually added, as in the syrup. The common buckthorn likewise produces extreme dryness of the mouth and throat.

Therapy.—Rhamnus catharticus may be employed in constipation and in dropsy, and was formerly used in the treatment of gout and rheumatism.

RHAMNUS PURSHIANA (U. S. P.).—**Cascara Sagrada.**

CASCARA SAGRADA (B. P.).—**Cascara Sagrada (Sacred Bark).**

Preparations.

Fluidextractum Rhamni Purshianæ (U. S. P.).—Fluid Extract of Cascara Sagrada. Dose, 1 to 4 c.cm. (or *m*xv-3j).

Fluidextracti Rhamni Purshianæ Aromaticum (U. S. P.).—Aromatic Fluid-Extract of Cascara Sagrada. Dose, 1 to 4 c.cm. (*m*xv-3j).

Extractum Cascaræ Sagradæ Liquidum (B. P.). — Liquid Extract of Cascara Sagrada. Dose, 2 to 4 c.cm. (or f3ss-j).

Extractum Cascaræ Sagradæ (B. P.).—Extract of Cascara Sagrada. Dose, 0.13 to 0.50 Gm. (or gr. ii-viij).

Syrupus Cascaræ Aromaticus (B. P.).—Aromatic Syrup of Cascara. Dose, 2 to 4 c.cm. (or f3ss-j).

Pharmacology.—Rhamnus purshiana (Rhamnaceæ) is a shrub or small tree, ten to twenty feet high, growing on the Pacific coast, and is sometimes known as the California buckthorn. The dried bark is the official portion, and must be collected for at least one year before being used (U. S. P.). An analysis by Prof. A. B. Prescott[1] showed its chief constituents to be a bitter, brown resin; a red resin; a light-yellow resin; tannic, malic, and oxalic acids; a neutral, crystallizable substance; a volatile oil (probably identical with **Quebrachol**), wax-starch, and a fat oil of yellowish color. It contains considerable **Emodin,** which Jowett claims is not active, and some Isoemodin. Leprince extracted from the bark a substance which he thought might be the active principle and which he called **cascarin.** Jowett has shown that cascarin and purshianin are only impure **emodin.** The active principle is probably a derivative of the glucoside found in the bark. The alcoholic extract, treated with water and lead subacetate, precipitated a sticky mass which has active physiological effects. The laxative principle is soluble in ether, but insoluble in water. According to M. Phipson, cascarin is identical with rhamnoxanthin derived from Rhamnus frangula.

[1] "New Preparations," Feb., 1879, page 27.

Physiological Action.—Cascara sagrada is not so much a purgative as it is a laxative with tonic properties, the latter being attributed to the bitter principle. In a number of clinical cases, Mr. Milnes Hey has noticed that it also produced a sensible diuretic effect. Cascarin appears to have a slight cholagogic action. In ordinary dosage it causes an easy evacuation of the bowels without griping, does not excite nausea or diarrhœa, and its use is not followed by constipation. Cascarin may be given in the dose of 0.10 to 1 Gm. (or gr. iss-xv).

Therapy.—Cascara sagrada, in the form of fluid extract (in doses of 1 c.cm., or *m*xv, three times daily), is useful in chronic constipation. The dose should be gradually increased until the bowels are moved naturally once daily; the remedy can then be given less frequently and the dose reduced. It is a peculiarity of this drug that it is not a cathartic, and its use should be preceded by a dose of castor-oil to clear the alimentary canal. It has the advantage of producing natural motions of the bowels by its tonic action upon the intestinal glands, increasing secretion and peristalsis. The dose is reduced after the natural condition of the bowels is established; it does not require to be given in increasing quantities, as do the ordinary resin-bearing cathartics. It also is a valuable hepatic tonic in congested liver and in duodenal catarrh. Cases of indigestion, with furred tongue, sallow skin, eructations of gas, and constipation, are benefited by the following prescription:—

℞ Fluidext. rhamni purshianæ ..... 30| c.cm. or f℥j.
Glycerini,
Elixir aromat..... aa 15| c.cm. or f℥ss.

M. Sig.: Take from one-half to one teaspoonful, directly after eating, three times daily, until the symptoms are relieved.

A combination made use of by Dujardin-Beaumetz in cases of chronic constipation is:—

℞ Fluidextracti rhamni pursh.,
Glycerin. pur. ..... aa 90| c.cm. or f℥iij.
Alcohol. (90°).....180| c.cm. or f℥vj.
Syrup. simpl. .....360| c.cm. or f℥xij.
Ol. aurantii ..... |37 c.cm. or *m*vj.
Ol. cinnamomi ..... |12 c.cm. or *m*ij.
Aq. destill. .....q. s. ad 840| c.cm. or Oi ³/₄.

M. Sig.: Dose, one or two teaspoonfuls.

In cases of chlorosis, Lutaud gives:—

℞ Ammonii et ferri citrat. ..... 40 parts.
Fluidext. rhamni purshianæ ..... 40 parts.
Saccharin. ..... 1 part.
Aquæ destillatæ .....4000 parts.

M. Sig.: A teaspoonful to be taken before each meal, for constipation.

In atony of the bowels a combination with berberis aquifolium is useful:—

℞ Fluidext. rhamni pursh.
Fluidext. berberidis aquifol.,
Syrupi ..... aa 30| c.cm. or f℥j.

M. Sig.: Dose, a teaspoonful four times a day.

In constipation with gastric irritability, Dr. J. H. Bundy, of California, who first introduced the remedy to the profession, proposed the following:—

℞ Fluidext. rhamni pursh.	15	c.cm. or f℥ss.
Fluidext. berberidis aquifol.	30	c.cm. or f℥j.
Acid. hydrocyanici dilut.	4	c.cm. or f3j.
Syrup. (vel ext. malti) q. s. ad	120	c.cm. or f℥iv.

M. Sig.: Teaspoonful after meals and at bed-time.

According to the experience of J. C. Stephens, cascara sagrada is also an efficient tæniafuge.

Where the bitterness is an objection, we may use as a vehicle a cordial, in which the taste is well covered by aromatics. The solid extract of cascara sagrada makes a pill-mass which does not soften or decompose when made up with powdered marshmallow. A commercial preparation, cascarin (not official) is presented in scale form, which is not hygroscopic, is readily reduced to powder, almost tasteless, soluble in water, and contains, it is claimed, the active principles of the drug. (Dose, 0.015 to 0.03 Gm., or gr. $^1/_4$-$^1/_2$.)

RHEUM (U. S. P.).—**Rhubarb.**

RHEI RADIX (B. P.).—**Rhubarb-root.**

Dose, 0.065 to 1.30 Gm. (or gr. i-xx).

Preparations.

Fluidextractum Rhei (U. S. P.).—Fluid Extract of Rhubarb. Dose, 0.60 to 4 c.cm. (or *m*x-f3j).

Mistura Rhei et Sodæ (U. S. P.).—Mixture of Rhubarb and Soda (fluid extract rhubarb, 15; fluid extract ipecac, 3; sodium bicarbonate, 35; glycerin, 350; spirit of peppermint, 35; water, q. s. ad 1000 parts). Dose, 4 to 60 c.cm. (or f3i-f℥ij).

Syrupus Rhei Aromaticus (U. S. P.).—Spiced Syrup of Rhubarb (aromatic tincture of rhubarb, 15 per cent., and simple syrup). Dose, 15 c.cm. (or f℥ss).

Tinctura Rhei (U. S. P.).—Tincture of Rhubarb (20 per cent.). Dose, 1.20 to 15 c.cm. (or *m*xx-f℥ss).

Tinctura Rhei Aromatica (U. S. P.).—Aromatic Tincture of Rhubarb (rhubarb, cinnamon, cloves, nutmeg, glycerin, diluted alcohol, and water, q. s. ad 1000 parts). Dose, 4 to 15 c.cm. (or f3i-iv).

Extractum Rhei (U. S. P., B. P.).—Extract of Rhubarb. Dose, 0.13 to 0.65 Gm. (or gr. ii-x).

Pulvis Rhei Compositus (U. S. P., B. P.).—Compound Rhubarb Powder (U. S. P. contains rhubarb, 25; magnesia, 65; and ginger, 10 parts). Gregory's Powder. Dose, 2 to 4 Gm. (or 3ss-j).

Syrupus Rhei (U. S. P., B. P.).—Syrup of Rhubarb (U. S. P. contains fluid extract, 10 per cent.). Dose, 4 to 15 c.cm. (or f3i-iv). B. P., 2 to 4 c.cm. (or f3ss-j).

Pilulæ Rhei Compositæ (U. S. P., B. P.).—Compound Pills of Rhubarb (U. S. P., rhubarb, aloes, and myrrh). Dose, 1 to 3. B. P., 0.25 to 0.50 Gm. (or gr. iv-viij).

Tinctura Rhei Composita (B. P.).—Compound Tincture of Rhubarb. Dose, 2 to 4 c.cm. (or f3ss-j); for a single administration, 7.5 to 15 c.cm. (or f3ii-iv).

Liquor Rhei Concentratus (B. P.).—Concentrated Solution of Rhubarb. Dose, 2 to 4 c.cm. (or f3ss-j).

Infusum Rhei (B. P.).—Infusion of Rhubarb (5 per cent.). Dose, 15 to 30 c.cm. (or f℥ss-j).

Acidum Chrysophanicum.—Chrysophanic Acid.

Pharmacology.—Rhubarb is "the dried rhizome of Rheum officinale, Rheum palmatum, and the variety tanguticum, or probably other species

of Rheum (Polygonaceæ), grown in China and Thibet, deprived of most of the bark and carefully dried (U. S. P.); "the erect rhizome, or so-called root, of Rheum palmatum, Rheum officinale, and probably other species, deprived of more or less of its cortex, and dried" (B. P.). The botanical origin of Rheum is Asia. The European rhubarb, R. rhaponticum, is not one-half as active and is not recognized by the pharmacopœias. The peeled and dried root of the Chinese or East India rhubarb, of a light color and characteristic odor, only should be used in medicine; powdered rhubarb is inferior, and, when not adulterated, is at least largely made up of inferior, damaged, and worthless, or worm-eaten, rhubarb. The active principles are a glucoside called **Chrysophan,** with **Emodin** and certain resins; **Chrysophanic acid, Phæorhetin, Erythrorhetin, Aporhetin, Rheotannic and Rheumic acids.** The grittiness of rhubarb is due to crystals of calcium oxalate contained in the root. **Cathartic acid,** which appears to be composed of several constituents, is purgative in doses of 0.13 to 0.30 Gm. (or gr. ii-v).

Physiological Action. — When taken into the mouth, rhubarb has a peculiar, bitter, slightly astringent taste, and increases the flow of saliva; in the stomach and intestinal tract the secretions are likewise increased and the peristaltic movements stimulated proportionately to the size of the dose, but after the first effects have been displayed the secretions are reduced by the secondary astringent action of the drug. The resinous constituents act upon the liver, increasing the quantity of bile; according to Rutherford, it is a certain, though not a powerful, hepatic stimulant. The bile secreted under its influence has the normal composition, and it is, therefore, a true cholagogue. The coloring matter is largely excreted by the kidneys, and the urinary flow is increased. The color may resemble that of urine which contains bile, but may be distinguished from the latter by becoming purplish red on addition of an alkali.

In small doses, up to 0.32 Gm. (or gr. v), rhubarb is a stomachic tonic, which makes it a valuable constituent in dinner pills to aid digestion and prevent constipation. As a purgative, in doses of 2 to 4 Gm. (or ʒss-j), it acts slowly and in the course of seven or eight hours produces copious yellow stools containing bile. Griping may be due to the drug itself, or to the bile which is poured out under the action of its resinous constituents, notably phæorhetin. The cathartic principles may be absorbed through the integument, when applied on a poultice or spongiopilin; it is, therefore, a systemic purgative. These purgative constituents are excreted by the liver mainly, but also by the intestinal glands, the kidneys, and skin. After a woman has taken a dose of rhubarb, her milk may contain enough of these principles to purge the nursing child, and may acquire a yellowish tinge from the presence of the coloring matter of the drug.

A case has been reported in which the internal administration of rhubarb gave rise to an hæmorrhagic eruption of macules, pustules, and blebs. The mucous membranes were also affected, and free hæmorrhage took place from the urethra.

Therapy.—Rhubarb is a slowly acting purgative, of service especially in the treatment of children's disorders caused by errors in diet, rich food, etc. The spiced syrup of rhubarb in teaspoonful doses may be given to an infant with indigestible food or curd in its stomach, or when its gastro-intestinal tract contains mucus from bronchial catarrh, etc. The mixture of rhubarb

and soda is a good antacid and carminative for babies suffering with colic and cramps. In adults it may be given with special advantage in hot water, fifteen or twenty minutes before eating meals, especially in cases of gastric catarrh. In summer diarrhœas of adults or infants the irritation arising from the presence of unsuitable or undigestible food is at once relieved and the cause removed by a dose of the aromatic syrup or tincture of rhubarb. Where there is intestinal dyspepsia and colalgia or cramps, the sweet tincture will be found very efficient and acceptable. Rhubarb may be combined thus:—

℞ Pulv. rhei	6	Gm. or 3iss.
Sodii bicarb.	8	Gm. or 3ij.
Spiritus ammonii aromat.	11	c.cm. or f3iij.
Spiritus myristicæ	22	c.cm. or f3vj.
Infus. caryophylli q. s. ad	240	c.cm. or f℥viij.

M. Sig.: A half to a tablespoonful three or four times a day.

In children with acid discharges from the bowels, the combination with magnesia is especially useful. In weak digestion with deficient secretion, small doses of the tincture are valuable:—

℞ Tinct. rhei	7|5	c.cm. or f3ij.
Tinct. cardamom. co., Elixir aromatic aa	15	c.cm. or f℥ss.

M. Sig.: Take twenty to forty drops before each meal.

Sidney Martin finds small doses of rhubarb efficacious in ascarides, his prescription being:—

℞ Tr. rhei	1|20	c.cm. or *mxx*.
Magnes. carbonatis	20	Gm. or gr. iij.
Tr. zingiber.	06	c.cm. or *mj*.
Aquæ	11	c.cm. or f3iij.

M. Sig.: To be taken at a dose. Repeat two or three times daily, according to the effect.

Urticaria, due to indigestion, may sometimes be relieved by rhubarb with magnesia, but without the ginger. It is a useful ingredient in purgative pills, where a cholagogic effect is desired, especially where hæmorrhoids are present:—

℞ Massæ hydrarg.	38 Gm. or gr. vj.
Ext. rhei	20 Gm. or gr. iij.
Ext. colocynth. co.	38 Gm. or gr. vj.
Saponis	03 Gm. or gr. ss.

M. et ft. pil. no. iij.
Sig.: To be taken at bed-time, and followed in the morning by a teaspoonful of Rochelle salt in water before breakfast.

Constipation and hæmorrhoids, during pregnancy, are benefited by the administration of rhubarb. This remedy is considered by some practitioners as of special value in gouty subjects. Rhubarb has been known to cause a macular, or vesicular, rash.

RHŒADOS PETALA (B. P.).—**Red-Poppy Petals.**

Preparation.

Syrupus Rhœados (B. P.).—Syrup of Red Poppy. Dose, 2 to 4 c.cm. (or f3ss-j).

The fresh petals of Papaver rhœas (Papaveraceæ), or cornflower, have a narcotic smell, when fresh, and it has been asserted that they contain a small proportion of the opium alkaloid, although Attfield was not able to detect any morphine. Hesse isolated from this plant an alkaloid, for which he proposed the name of **rhœadine,** which appeared to be devoid of toxic properties. According to the same observer, the juice from the capsules contains *meconic acid.*

Red-poppy petals are employed in pharmacy to supply a beautiful red color to preparations. It is doubtful if they have any medicinal virtues.

RHŒAS.—Red Poppy.

Pharmacology and Therapy. — The petals of the red poppy, Papaver rhœas (Papaveraceæ), cultivated in gardens, contain a coloring matter and **Rhœadine,** but only a trace of morphine. The preparations are used as coloring agents in pharmacy; although doses are quoted below, the remedy is seldom, if ever, employed. The taste is mucilaginous and bitter; it may act as a simple bitter, as a stomachic tonic during convalescence. The following preparations are listed: Fluidextractum rhœados (fluid extract of poppy-flowers); dose, 2 to 6 c.cm. (or *m*xxx-f℥iss). Syrupus rhœados (syrup of red poppy); dose, 4 to 7.50 c.cm. (or f℥i-ij).

RHUS AROMATICA.—Fragrant, or **Sweet, Sumach.** The bark of the root of Rhus aromatica (Anacardieæ), growing in the eastern portion of this country, contains a resin, volatile oil, and tannin.

Physiological Action.—Rhus aromatica is astringent, tonic, stimulant, and diuretic.

Therapy.—Sweet sumach has been used as an astringent in diseases of the kidneys and genito-urinary tract, as in cystitis and hæmaturia. It is likewise said to check menorrhagia and night-sweats. It is employed in atonic diarrhœa or summer dysentery, after a preliminary purge to remove offending substances from the alimentary canal. It has been lauded as a remedy for nocturnal enuresis of children, 4 c.cm. (or f℥j) of a good fluid extract being administered in diminished doses during the day. In larger doses this drug has exerted a good effect in hysterical enuresis. In diabetes, both mellitus and insipidus, it has also proved of service.

RHUS GLABRA (U. S. P.).—**Rhus Glabra, Smooth Sumach.**

Preparation.

Fluidextractum Rhois Glabræ (U. S. P.).—Fluid Extract of Rhus Glabra. Dose, 4 to 7.5 c.cm. (or f℥i-ij).

Pharmacology.—"The dried fruit of Rhus glabra" (Anacardiaceæ), a common shrub along the roadsides in the United States, contains **tannic acid,** besides potassium and calcium malates and a red coloring matter.

Therapy.—Rhus glabra is a good astringent in the form of decoction, or fluid extract, for a mouth-wash or gargle in stomatitis, spongy gums, or pharyngitis, and as a topical application in skin diseases and ulcers in domestic practice. The following is a useful gargle for sore throat:—

℞ Potassii chloratis	8	Gm. or ℥ij.
Fluidext. rhois glabræ	15	c.cm. or f℥ss.
Glycerini	45	c.cm. or f℥iss.
Aquæ rosæ	120	c.cm. or f℥iv.

M. Sig.: Add a tablespoonful to a wineglassful of water, and use as a gargle, frequently.

RHUS TOXICODENDRON.—Rhus Toxicodendron, Poison-ivy.

Pharmacology.—The fresh leaflets of Rhus radicans (Anacardiaceæ), indigenous to the eastern portion of North America. The active principle was thought by Maisch to be **toxicodendric acid**, but this has since been found, when pure, to be non-toxic and have the characters of acetic acid. The active principle is volatile and is probably a fat acid. A resin and a peculiar fixed oil, **toxicodendrol**, are present in the leaves. As the chief constituent is volatile, the fresh leaves only are used; dried leaves are worthless. Several other species of rhus, as the swamp-sumach (R. venenata), contain this constituent. The swamp-sumach (rhus vernix or rhus venenata) has pinnate leaves, and somewhat resembles Rhus glabra. It always grows in wet ground. A closely allied species grows in Japan (R. vernicifera). The lac or varnish upon Chinese or Japanese boxes is made of this species of sumach, and very susceptible individuals may be poisoned by handling them, or by being present when such varnish is used. The rhus radicans is also known as rhus toxicodendron; it is sometimes erect and sometimes climbing. The poison-sumach may be recognized by trifoliate, compound leaves, resembling the ordinary ivy in having adventitious roots along the under side of the climbing stem, with the exception that in the poison-sumach the roots are given off in bunches at the nodes opposite the insertion of the petiole or leaf-stem, while in the ivy they grow from the entire under side of the stem. It is distinguished from the Ptelea trifoliata by having petiolate instead of sessile leaflets. The poisonous principle resides especially in the juice.

Physiological Action.—The fresh leaves are very irritating to the skin, although the effect is much more marked in some individuals than in others. In characteristic cases of poisoning there is set up an acute dermatitis, with a great deal of œdema and hyperæmia of the skin; frequently vesicles or blebs are formed, accompanied by much irritation and itching. This inflammation resembles erysipelas, spreading from the parts first affected to surrounding skin and mucous membrane. With this there is considerable general disturbance, pains in the abdomen, nausea, and vomiting; diarrhœa or diuresis may occur, with passage of blood. Fever and profuse perspiration may also be observed, with pains in the joints and lumbar region. The effects of the poison last from a week to a fortnight, and are followed by free desquamation of the affected surface.

Poisoning.—Many remedies have been advocated; the free application of a carbolized alkaline wash to neutralize the poison, or soap suds, followed by fluid extract of grindelia diluted with water (1 to 10) or distilled extract of hamamelis, is very good. Quinine sulphate in recently-boiled water (1 per cent. strength) is an efficient application,[1] according to Dr. T. J. Daniel, of Magazine, Ark. Prof. Wormley preferred a mixture of 1 part of carbolic acid, 6 parts of sodium bisulphite, and 100 parts of water. The fluid extract of Virginia snake-root is said to be advantageous. Dr. S. B. Straley, of Huntsville, N. J., has found that a strong decoction of chestnut-leaves applied to the affected part every few hours has a very beneficial effect in reducing heat, itching, and smarting. Other remedies which have been used with good effect are decoctions of white- or black- oak bark, or dusting the surface freely with powdered aristol. Relief may also be afforded by the use of lime-water or Labarraque's solution. An infusion of lobelia, in the proportion

[1] *Medical Bulletin*, Sept., 1906.

of 31 Gm. to 473 c.cm. (or ℥i-Oj) of water, also is of service in this condition of local poisoning. Dr. R. L. Hinton extols an infusion of sassafras-bark. Compresses saturated in the cold infusion are applied to the affected surface, and the warm infusion is given internally, sweetened or with milk. When the inflammation is in the face, and accompanied by much swelling of the eyelids, alum curd is very efficient. Ointment of the oxide of zinc with carbolic acid (3 per cent.) is useful to heal the lesions of the skin.

Therapy. — Rhus toxicodendron is rarely employed in medicine, although Phillips declares that it is useful in rheumatic pains and affections of fibrous tissues; also in certain skin affections, erythema, erysipelas, herpes, and pemphigus. In rheumatic paralysis it is claimed to be efficient. Dr. E. Carmichael Rothrock considers rhus toxicodendron as an excellent cerebral and spinal stimulant. Externally, 2 c.cm. (or f℥ss) of the tincture (1 to 2 of alcohol) in a pint of water may be used as a stimulating application, with advantage, for sprains, chilblains, burns, stings of insects, etc.

A tincture (1 part of the dry leaves to 5 parts, by weight, of alcohol) of rhus radicans, or poison-ivy, is recommended by Dr. Saint-Phillipe, of Bordeaux, as a good remedy in the nocturnal enuresis of children. He administers to children, under 6 years of age, 0.30 c.cm. (or *m*v) of this preparation night and morning.

RICINI OLEUM (U. S. P., B. P.).—**Castor-oil.** (See **Oleum Ricini.**)

ROSA GALLICA (U. S. P.).—**Red Rose.** The dried petals of Rosa gallica collected before expanding (Rosaceæ).

ROSÆ GALLICÆ PETALA (B. P.).—**Red-Rose Petals.** The fresh and dried unexpanded petals of Rosa Gallica.

Preparations.

Fluidextractum Rosæ (U. S. P.).—Fluid Extract of Rose (from red roses). Dose, 0.30 to 4 c.cm. (or *m*v-f℥j).

Confectio Rosæ (U. S. P.).—Confection of Rose (red rose, sugar, honey, and stronger rose-water).

Mel Rosæ (U. S. P.).—Honey of Rose.

Pilulæ Aloes et Mastiches (U. S. P.).—Pills of Aloes and Mastic. Dose, 1 to 3.

Aquæ Rosæ Fortior (U. S. P.).—Stronger Rose-water. (For making rose-water.)

Aqua Rosæ (U. S. P., B. P.).—Rose-water.

Syrupus Rosæ (U. S. P., B. P.).—Syrup of Roses (U. S. P. contains fluid extract, 12 ½ per cent.). As a vehicle.

Oleum Rosæ (U. S. P., B. P.).—Oil of Rose ("attar of rose"). The volatile oil distilled from the fresh flowers of Rosa damascena (Rosaceæ).

Unguentum Aquæ Rosæ (U. S. P., B. P.).—Rose-water Ointment, Cold Cream.

Confectio Rosæ Gallicæ (B. P.). — Confection of Roses (red-rose petals and sugar).

Infusum Rosæ Acidum (B. P.).—Acid Infusion of Roses (red-rose petals, 25 Gm.; diluted sulphuric acid, 12.5 c.cm.; distilled water, boiling, 1000 c.cm.). Dose, 15 to 30 c.cm. (or f℥ss-j).

Pharmacology.—Red rose contains **tannic** and **gallic acids** and a **volatile oil,** which the pharmacopœias direct shall be obtained from another species. Red rose is an ingredient in the U. S. P. pills of aloes and mastic. The British Pharmacopœia contains an acid infusion of rose, which is an agreeable mouth-wash for low fevers. It may be given internally, and is an agreeable method of administering sulphuric acid. Rose-water is a component of the compound iron mixture.

Physiological Action and Therapy.—Preparations of rose are somewhat astringent. They are used as agreeable flavoring agents and vehicles. The confection is a good base for pills. The compound infusion is of service for overcoming the bad taste of magnesium sulphate. Aqua rosæ is a favorable vehicle for eye-washes, urethral injections, and cosmetic preparations. Rose-water ointment is an elegant, bland unguent, principally used as an excipient, but available in superficial burns, chapped lips or hands, abrasions, and erythema.

ROSMARINUS.—Rosemary.

Preparations.

Oleum Rosmarini (U. S. P., B. P.).—Oil of Rosemary. Dose, 0.06 to 0.30 c.cm. (or *m*i-v).

Tinctura Lavandulæ Composita (U. S. P., B. P.).—Compound Tincture of Lavender. Dose, 2 to 4 c.cm. (or *m*xxx-f3j).

Spiritus Rosmarini (B. P.).—Spirit of Rosemary (10 per cent. of oil).

Pharmacology.—The dried leaves of Rosmarinus officinalis (Labiatæ) are aromatic, pungent, and bitter. They contain **volatile oil** (about 1 per cent.), some resin, tannin, and a bitter principle. Rosemary enters into aromatic wine, perfumed spirit, or *eau-de-Cologne,* soap liniment, and compound tincture of lavender.

Physiological Action. — Rosemary is stimulant, diuretic, carminative, emmenagogue, and somewhat diaphoretic, but is now rarely employed in substance, the oil taking its place. The latter is stimulant and carminative. It reduces temperature, imparts a peculiar odor to the urine, and in large quantities has caused death. It is chiefly used as a rubefacient in liniments and ointments.

Therapy.—In alopecia from defective nutrition of hair-bulbs, a lotion containing oil of rosemary and tincture of cantharides, with Cologne water, is frequently given. It may also be used as a rubefacient for sprains and painful joints, and is efficacious in the different forms of pediculosis. The compound rosemary ointment of the German Pharmacopœia contains 1 part each of oil of rosemary and oil of juniper-berries in 30 parts of ointment, and is used in neuralgia, chronic rheumatism, and lumbago. The oil of rosemary is of some service as an internal remedy in hysteria accompanied by depressed spirits.

From 6 to 12 Gm. (or 3iss-iij) of the **Rosmarinus sylvestre,** dried and powdered, taken as a hot, recent infusion, are said by Sznabl to produce a decided diaphoretic effect.

RUBIDIUM.—Rubidium is one of the rarer metals, and belongs to the series of the alkalies. It is of a soft, wax-like consistence; is easily fused; readily unites with acids and haloids to form salts, and ignites spontaneously in the air. Its salts communicate a violet color to flame and possess a high electrolytic conductivity. Heretofore the cost of separating the metal from the substances with which it was found united in nature has been too great to allow its medicinal use. Recently, however, a new process has permitted its more economical production.

Rubidium iodide is the salt which has been almost exclusively used. It is a white, crystalline substance, which does not effloresce, is without odor,

and has a milder taste than potassium iodide. It is, moreover, more soluble in water than the corresponding salt of potassium.

Physiological Action.—The salts of rubidium exert a far less depressant action upon the heart than those of potassium. The iodide does not diminish appetite or impair digestion, does not disturb the circulation, and is less apt than the corresponding salt of potassium to produce the phenomena of iodism. Rubidium chloride, according to Picket, causes death in animals by exhausting the nervous system and depressing the action of the heart.

Therapy.—Rubidium iodide has been used with advantage to fill many indications of the potassium salt, for which it will prove, in many instances at least, an efficient substitute. In the eye clinic of Professor Schöler, of Berlin, rubidium iodide in 5-per-cent. aqueous solution or vaselin ointment of the same strength has been successfully employed in affections where the action of an absorbifacient was demanded. Its internal use was conjoined, and Professor Bunge, of Halle, reports it of value in chronic inflammation of the eyes of a non-syphilitic nature, and especially in chronic optic neuritis. Internally, it has been chiefly given in visceral syphilis, gummata, and late ulcerated lesions. Its efficacy is thought to be at least equal to that of potassium iodide. It has also been found of avail in chronic rheumatism and in the removal of old inflammatory exudations. A favorable report has also been made of its action in gonorrhœal rheumatism. Rubidium and ammonium bromide was proposed by Laufenauer as a *succedaneum* for the older bromides, upon the ground that it contained a larger proportion of bromine. He prescribed it in daily doses of 6 to 6.50 Gm. (or gr. xc-c).

RUBUS (U. S. P.).—Blackberry.

Preparations.

Fluidextractum Rubi (U. S. P.).—Fluid Extract of Rubus. Dose, 2 c.cm. (or f℥ss).

Syrupus Rubi (U. S. P.).—Syrup of Rubus (containing fluid extract, 25 per cent.). Dose, 4 to 30 c.cm. (or f℥i-f℥j).

Unofficial Preparations.

Syrupus Rubi Aromaticus (N. F.).—Aromatic Blackberry-syrup (blackberry, cinnamon, nutmeg, cloves, and allspice). Dose, 4 to 15 c.cm. (or f℥i-iv).

Elixir Rubi.—Blackberry-brandy (fluid extract blackberry-root, 5; aromatic fluid extract, ½; brandy, 13½; syrup of blackberries, 17; elixir, 17 parts). Dose, 7.5 to 15 c.cm. (or f℥ii-f℥ss).

Elixir Rubi Compositum (N. F.).—Blackberry Compound (blackberry-root, galls, and cinnamon, each, 10 parts; with cloves, mace, ginger, in blackberry-juice and syrup). Dose, 4 to 15 c.cm. (or f℥i-f℥ss).

Cordialis Rubi Fructus.—Blackberry-cordial (fresh blackberry-juice, 3; cinnamon, cloves, and nutmeg, in tincture with dilute alcohol, 2; simple syrup, 3 parts). Dose, 4 to 30 c.cm. (or f℥i-f℥j).

Pharmacology.—"The dried bark of the rhizome of Rubus villosus, Rubus nigrobaccus, or of Rubus cuneifolius" (Rosaceæ) is official as Rubus. The wood should be rejected, only the bark being of medicinal value. It contains tannic acid (10 per cent.). The fluid extract is made by percolation with diluted alcohol, and contains glycerin (10 per cent.).

Physiological Action.—Blackberry is astringent.

Therapy. — In diarrhœa of relaxation, especially after cleansing the bowels with castor-oil, the preparations of blackberry are useful. The com-

binations of the fruit for the table (jams, preserves, etc.) are not astringent, and are not only useless in treating diarrhœa, but also injurious, since the hard seeds increase the irritation. The best form is the fluid extract, but there is a popular demand for blackberry-cordials and blackberry-brandy, for which formulæ are given above. They are pleasant to the taste, carminative, and slightly astringent.

RUBUS IDÆUS.—Raspberry.

Preparation.

Syrupus Rubi Idæi.—Syrup of Raspberry. As a vehicle.

Pharmacology.—"The fruit of Rubus idæus" (Rosaceæ) has a pleasant flavor. It contains sugar, malic and citric acids, pectin, proteids, coloring matter, and a trace of volatile oil, consisting of compound ethers producing the peculiar flavor.

Therapy.—Its sole use in medicine is to prepare the syrup, which has a pleasant, acid taste and a fruity odor. The leaves of the wild raspberry (R. strigosus) contain tannin, and are used in decoction as an astringent in diarrhœa. Raspberry-syrup with vinegar is a popular and grateful drink in hot weather, added to cold water.

RUMEX.—Rumex, Yellow Dock.

Preparation.

Fluidextractum Rumicis.—Fluid Extract of Rumex. Dose, 2 to 4 c.cm. (or f3ss-j).

Pharmacology.—Rumex is "the dried root of Rumex crispus, and of other species of Rumex" (Polygonaceæ), growing along roadsides in Europe and America. The official root is eight by twelve inches long, one-half inch thick, somewhat fusiform. It contains tannin, chrysophanic acid, mucilage, calcium oxalate, starch, etc.

Physiological Action.—Rumex is alterative, tonic, and slightly astringent.

Therapy.—In strumous affections, especially enlargement of the glands and cutaneous disorders, rumex has been found particularly valuable. It is also considered antiscorbutic. In chronic laryngeal affections, with cough and soreness under the sternum, it will give relief. The decoction is sometimes employed externally in various skin diseases and glandular swellings. Also used internally in dyspepsia and liver disorders.

RUTÆ OLEUM.—Oil of Rue. (See **Oleum Rutæ.**)

SABADILLA.—Cevadilla. The dried, ripe seeds of Asagræa officinalis (Liliaceæ), of Mexico, contain **Veratrine, Cevadine,** and **Cevadilline,** combined with **Cevadic** and **Cevadillic Acids.** Two new alkaloids have been isolated by E. Merck, who has called them **Sabadine** and **Sabadinine. Sabadilline** was discovered by Meissner.

Physiological Action and Therapy.—An ointment has been used to destroy lice and other vermin, and as a cure for itch. Sabadilla was formerly used as a tæniacide in doses of 0.30 to 1.30 Gm. (or gr. v-xx), but its action

was too violent, causing both vomiting and purging, so that it was abandoned. Cevadilla is a powerful emetic, cathartic, and anthelmintic, and has been given in doses of 0.065 to 0.32 Gm. (or gr. i-v). It is seldom now used, and its principal value is as a source of the mixed alkaloids known as veratrine. (See **Veratrina.**)

SABAL (U. S. P.).—**Saw-palmetto.** The partially dried fruit of Serenoa serrulata (Palmaceæ). The saw-palmetto grows along the sea-coast from South Carolina to Florida, and is found as far as eight or ten miles inland. This plant possesses a creeping and branched stem, leaves of a bright-green color, fan-shaped and spiculated. The roots, large and fibrous, extend several feet from the stem, and are half-exposed above the sand. The berries, or drupes, of a dark-purple color, and about the size of an olive, ripen in October and November. The seeds are very hard, and enveloped in a tough, fibrous membrane. The fruit contains a volatile oil (soluble in alcohol), a fixed oil, and a large proportion of saccharin matter.

Physiological Action.—The taste, at first sweet, soon becomes acrid and pungent; to the pungent succeeds a smooth sensation, which extends from the tongue and mouth to the larynx and nasal cavities, all of which parts feel as if lubricated with oil. Saw-palmetto is said to increase appetite, digestion, and strength, and to promote nutrition. It also exerts a sedative and diuretic influence, and has been thought to have a special tonic effect upon the reproductive system. The berries seem to have nutrient value, as the animals who feed upon them rapidly fatten. The physiological action of saw-palmetto has not been systematically investigated.

Therapy.—Saw-palmetto is said to be an excellent expectorant, and, at the same time, a sedative to the mucous membranes of the respiratory tract. Troublesome nervous cough is allayed and secretion promoted by its use. This remedy has been employed with benefit in coryza, acute and chronic laryngitis, and bronchitis. Bronchorrhœa with bronchiectasis is relieved by the administration of sabal serrulata. Dr. Read[1] states that an acute nasal catarrh may be aborted by two or three doses, and that the vapor is inhaled with advantage in chronic ozæna. Sabal is claimed to possess some efficiency in cardiac asthma. On account of its combination of tonic and expectorant properties it has been found of service in phthisis pulmonalis, and especially in tuberculosis of the larynx. Saw-palmetto is thought to be valuable in atrophy of the mammæ, testicles, or uterus, and to exert a beneficial influence upon enlarged prostate. This remedy is likewise recommended for functional impotence. A fluid extract is the best preparation. Dose, 2 to 7.50 c.cm. (or f3ss-ij).

SABBATIA. — American Centaury. The entire flowering plants of Sabbatia angularis and of Sabbatia paniculata (Gentianaceæ) are used in medicine for the same purposes as gentian, calumba, and other simple bitters. A solid extract, obtained by evaporating the fluid extract and adding 5 per cent. of glycerin, may be given as a tonic in atonic dyspepsia in doses of 0.13 to 0.75 Gm. (or gr. ii-xij).

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[1] "Sabal Serrulata, Saw-palmetto," by Dr. J. B. Read, of Savannah, Georgia, *American Journal of Pharmacy*, April, 1879, p. 169.

SABINA (U. S. P.).—**Savin.**

Preparations.

Fluidextractum Sabinæ (U. S. P.).—Fluid Extract of Savin. Dose, 0.30 to 1.20 c.cm. (or *m*v-xx).

Oleum Sabinæ (U. S. P.).—Oil of Savin. Dose, 0.12 to 0.30 c.cm. (or *m*ii-v).

Pharmacology.—The tops of Juniperus Sabina (Coniferæ), a small evergreen tree common in the northern hemisphere, often cultivated as an ornamental shrub. It contains from 5 to 10 per cent. of a volatile oil, which, when separated by distillation, is official as oil of savin; also tannin, resin, etc. Oil of savin is colorless or yellowish, has a strong, characteristic smell, and a burning taste. It is freely soluble in absolute alcohol.

Physiological Action.—Locally, savin causes rubefaction, or even vesication. Internally, it is a stimulant to the digestive organs, increases the action of the heart, and stimulates the bronchial, cutaneous, and renal secretions. It causes hyperæmia of the kidneys, of the ovaries and uterus, and, in large doses, excites strangury, hæmaturia, violent vomiting and purging, gastro-enteritis, unconsciousness, stertor, and convulsions. Savin may, as part of its toxic effects, cause abortion in a pregnant woman, and death has occasionally resulted from its irritant action when administered for this purpose. The odor of savin appears in the breath, sweat, and urine as elimination takes place.

Therapy.—Savin used to be added to blisters, or blistered surfaces were dressed with savin ointment, to increase the effect, but this practice is now obsolete. The cerate may be applied as a caustic for the destruction of warts. A mixture of powdered savin and verdigris has been successfully employed for the removal of condylomata. Powdered savin may be used as a stimulant to indolent ulcers. A cerate or ointment of savin (25 per cent. of fluid extract with resin cerate) is a serviceable counter-irritant in chronic gout or rheumatism. This drug is efficient in tinea capitis and scabies, and has even been used internally with success as a tæniacide. As an emmenagogue, Phillips considers it highly valuable and safe, in proper doses. It is used in functional dysmenorrhœa, in passive hæmorrhages after abortion, and, as Whitla suggests, may prove beneficial in subinvolution of the uterus.

SACCHARINUM.—(See **Benzosulphinidum.**)

SACCHARUM (U. S. P.).—**Sugar, Cane-sugar.**

SACCHARUM PURIFICATUM (B. P.).—**Refined Sugar.**

Preparations.

Syrupus (U. S. P., B. P.).—Syrup.

Syrupus Glucosi (B. P.).—Syrup of Glucose (glucose, 2; syrup, 1).

Pharmacology.—The refined sugar obtained from Saccharum officinarum, and from various species or varieties of Sorghum (Gramineæ); and also from one or more varieties of Beta vulgaris (Chenopodiaceæ), U. S. P.; a crystallized sugar ($C_{12}H_{22}O_{11}$) obtained from the juice of the sugar-cane (B. P.). The U. S. P. official syrup consists of 85 parts of sugar, and water q. s. ad 100 parts. Sugar is the basis of syrups, conserves, and many other

pharmaceutical preparations. With lime it forms a chemical combination,—the saccharate of calcium,—which is an **antidote to carbolic acid**; it is official as Syrupus Calcis. Sugar takes a prominent place in modern life as an article of food. According to Dr. Bossi, sugar excites uterine contractions during labor. Sugar has a decided effect upon the mucous membrane of the air-passages, and various confections and troches are used in mouth and throat affections, and syrups are useful in bronchial disorders.

Saccharum lactis (U. S. P., B. P.), sugar of milk, is "a peculiar crystalline sugar obtained from the whey of cows' milk by evaporation and purified by recrystallization." It is also known as **lactose**; cane-sugar is **saccharose** and grape-sugar or starch-sugar is **glucose.** Sugar of milk is largely made in Switzerland from the whey remaining after making cheese. It is a white, rather gritty sugar, less sweet than saccharose, and has a neutral reaction. It is used in pharmacy, on account of its hardness, in making triturates. Lactose enters into the U. S. P. formula for making Dover's powder, and is used as a diluent for powders. It is said to be very commonly adulterated.

Sugar of milk, in the daily dose of 8 to 15.5 Gm. (or ʒii-iv), given in an abundance of water, exerts a decided diuretic influence and may be serviceably employed in cases of renal inactivity or dropsy. When used in preparing infant's food, the diuretic effect should not be overlooked.

Diabetin.—Under this name, levulose, a fruit-sugar, has been introduced as a food peculiarly adapted to the use of diabetic patients. Levulose is a pure, white, crystalline powder, soluble in water in almost every proportion. It has a sweet taste and leaves no disagreeable after-flavor. Diabetin possesses the same nutrient value as cane-sugar, and is said to be assimilated in diabetes, a small proportion only being excreted by the urine.

SAFROLUM (U. S. P.).—**Safrol.** (See **Sassafras.**)

SAGO.—Sago is a prepared starch from the interior of the stem of Metroxylon sagu or Sagus Rumphii (Palmaceæ) of the Indian Archipelago. It occurs in hard, whitish, spherical grains, which form a gelatinous mass with boiling water. Pearl sago is the best variety. An imitation sago is made from potatoes.

Therapy.—It is useful as an easily-digested and acceptable article of food for the sick when added to broth, or in the form of light puddings.

SALEP.—The tubers of several species of Orchis (Orchidaceæ, Ophrydeæ) growing in Germany and France, collected in the autumn, deprived of epidermis and dried. They contain **Bassorin** (48 per cent.), or vegetable mucilage, and **starch** (27 per cent.). With forty times its weight of boiling water, salep forms a thick jelly, which can be flavored and used as a nutritious food during convalescence from acute diseases and in bowel disorders.

SALICINUM (U. S. P., B. P.).—**Salicin** ($C_{13}H_{18}O_7$).

Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Pharmacology.—Salicin is "a glucoside, obtained from several species of Salix and Populus (Salicaceæ)." It appears in white, silky crystals, of very bitter taste. When boiled with diluted acids, it is resolved into grape-sugar, **saliretin,** and **saligenin,** or ortho-oxybenzyl-alcohol. Salicin dissolves

in water, alcohol, solutions of caustic potash and soda, and in glacial acetic acid. It is very sparingly soluble in ether and insoluble in chloroform.

Salicylic acid and the salicylates of sodium (see page 842), of lithium, and of physostigmine, are also official. The oil of gaultheria, or of birch, also contains salicin as methyl salicylate, and may be used to obtain salicylic acid, which, however, is usually prepared synthetically. Methyl salicylate is now official in the United States Pharmacopœia. (See **Gaultheria.**)

Physiological Action.—Willow bark is an astringent bitter tonic and antiperiodic. One variety, the **Salix nigra,** is considered a diuretic and sexual sedative, the fluid extract being used in doses of 1.20 to 2 c.cm. (or *m*xx-xxx) several times a day. Salicin acts as a bitter tonic, with antiperiodic and antiseptic powers. It is not toxic in the human subject, and is acceptable to the stomach. This agent is excreted mainly as salicyluric, salicylous, and salicylic acids by the kidneys. Salicin is not entirely, or always, decomposed after absorption, as it has been found in the urine under its own form. Its escape from the body is slow.

Therapy.—Salicin is a useful, bitter tonic, in feeble digestion, in doses of 0.13 to 0.32 Gm. (or gr. ii-v). In the diarrhœa of phthisis it is effective in restoring a more healthy condition and promoting digestion, and it also reduces the fever, given in doses of 1.30 Gm. (or gr. xx), two or three times daily:—

℞ Salicin.,
Bismuth. subnit. ..... aa 6|50 Gm. or gr. c.
Ol. cinnamomi ..... |06 c.c*m*.mj. or
M. et ft. capsulæ no. xx.
Sig.: One or two capsules every hour or two for diarrhœa.

Salicin is a beneficial remedy in the chronic diarrhœa of children. In acute rheumatism, Maclagan considers it safer than salicylic acid, as it does not depress the heart, the dose being from 0.65 to 3.25 Gm. (or gr. x-l) every three or four hours; or, in order to get the full antipyretic effect, these doses may be administered every hour until two or three are taken, and then less frequently.[1] He also commends its use in neuralgia and coryza. In full doses its antipyretic effect may be accompanied by free perspiration, but it is not toxic, and can be given in amounts of several drachms daily.

Dr. E. B. Turner praises the action of salicin in influenza, having treated more than two hundred consecutive cases by means of this agent, which was given to adults in doses of 1.30 Gm. (or gr. xx) every hour for ten or twelve successive hours, and to children in proportionate quantities, according to their age. In pelvic pain, dependent upon or aggravated by a rheumatic diathesis, Jules Chéron has often found 1 Gm. (or gr. xv) of salicin, administered in three doses, of decided efficacy. In certain cases of metritis, salpingo-ovaritis, pelvic cellulitis, or peritonitis, and in lumbo-abdominal neuralgia it may be given with advantage.

SALOL (B. P.).—$C_6H_5C_7H_5O_3$).
PHENYLIS SALICYLAS (U. S. P.).—**Phenyl Salicylate.**
Dose, 0.32 to 1 Gm. (or gr. v-xv).

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[1] See also article by author on "Rheumatic Fever" in *New York Medical Journal,* for February 24, 1906.

Pharmacology.—Phenyl salicylate, or salol, is an ester obtained by the action of condensing agents upon a mixture of salicylic acid and phenol, or the sodium compounds of the same ($C_6H_5C_7H_5O_3$). Salol is a white, crystalline powder, insoluble in water, odorless, and almost tasteless. It was first prepared by von Nencki in 1883, and introduced into practice in 1886 by Sahli. In the organism it becomes decomposed, yielding salicylic acid and carbolic acid in nascent form. It is antiseptic, germicide, and antipyretic to a more marked degree, and is proportionately less toxic than either of its constituents. Salol usually passes through the stomach unchanged. Its decomposition is effected, in the intestine, chiefly by means of the pancreatic fluid and partly, also, by the intestinal fluids. According to the experiments of Reale and Grande, salol may, at least in some cases, be broken up in the stomach into its component parts. Salol is also decomposed by the action of pus and the action of various bacteria.

The following tests are official (U. S. P.): Phenyl salicylate placed upon moistened blue litmus paper should not produce any reddish coloration (absence of free acid). If 1 Gm. of phenyl salicylate, shaken with 50 c.cm. of water, be filtered, the filtrate should show no color, or at most a trace, with ferric chloride test-solution previously diluted with 20 volumes of water (limit of uncombined salicylic acid and phenol). If a portion of the same filtrate be tested with barium-nitrate test-solution and silver-nitrate test-solution, it should show no turbidity (absence of sulphates and chlorides).

Physiological Action and Therapy.—It must not be forgotten that in administering salol internally the therapeutic effect is due to the salicylic acid and carbolic acid, and therefore that large doses cannot be given with impunity, for fear of phenol poisoning. Salol is absorbed slowly and eliminated slowly, so that there is danger of accumulation in the system if given too frequently, except where diarrhœa is present. M. Josias has reported the case of a young girl who had taken 3 Gm. (or gr. xlv) of salol in forty-eight hours, and in whom a large patch of scarlatiniform erythema, together with rose-colored papules and spots resembling those of measles, appeared in consequence upon various portions of the body. The insufflation of salol for the relief of otorrhœa has been known to cause extreme swelling of the external auditory meatus, the isthmus of the fauces, and uvula. Josefowitsch reports the case of a man, 40 years of age, to whom 22.6 Gm. (or gr. cccl) had been given in the course of four days, who suffered with intense albuminuria and violent pains in the loins. Black urine (carboluria) may continue for some time after its ingestion. Kobert insists that, from the large proportion of phenol which salol contains, it is, comparatively speaking, a toxic substance; so that any exceeding of the maximum dose must be regarded as hazardous. Dr. Hesselbach reported the case of a woman, who died after taking 8 Gm. (or ʒij) of salol, within eight hours. It was found that she had been suffering with chronic nephritis, which was made acute by the drug. From his study of the action of the agent, Hesselbach concludes, first, that the large proportion of phenol contained in salol renders it such a toxic substance that its unrestricted therapeutical use is fraught with danger; and, secondly, that in renal diseases, acute or chronic, salol is contra-indicated.[1] Dr. Chlapowski has recorded a case in which death resulted from the ingestion of 1 Gm. (or gr. xv). In rare instances, an erythematous eruption has been produced by

[1] "The Action of Salol on the Kidneys," *Therapeutic Gazette*, Oct., 1890, p. 704.

the local application of salol, probably in consequence of its decomposition.

Salol is an excellent dressing for wounds, burns, ulcers, erysipelas, and other cutaneous disorders. In impetigo contagiosa and pustular eczema, Egasse applies with advantage a collodion composed of:—

℞ Phenylis salicylat.	3	Gm. or gr. xlvj.
Cocain. hydrochloridi	20	Gm. or gr. iij.
Collodii flexilis	18 5	c.cm. or f3v.—M.

Camphor is liquefied by salol, and this is highly esteemed by Cuirllier in suppurative otitis. The meatus is first cleansed by a solution of boric acid, and the camphorat-salol applied upon a tampon of wool, which is left in position not more than twenty-four hours.[1] For ozæna, Cozzolini recommends:—

℞ Phenylis salicylat.	8	Gm. or 3ij.
Acidi borici	4	Gm. or 3j.
Acidi salicylici	75	Gm. or gr. xij.
Thymol.	32	Gm. or gr. v.
Pulv. talci	20	Gm. or gr. iij.

M. Sig.: Use by insufflation.

The formula for an excellent antiseptic powder, used in some of the hospitals, is given as follows:—

℞ Phenylis salicylat.	31	Gm. or ʒj.
Zinci sulphitis	46 5	Gm. or ʒiss.
Pulv. benzoini	15 5	Gm. or ʒss.
Talci purificat.	62	Gm. or ʒij.
Ol. fœniculi	1 2	c.cm. or *m*xx.

M. Useful for chronic ulcers, etc.

M. Valude recommends, in ulcer of the cornea, the application of a pad of moistened salol gauze which, with a gauze bandage, seals the eye and maintains a certain amount of compression. The eye is first carefully disinfected, the dressing placed in position and not removed for three or four days, when the ulcer is found to be in process of repair. M. Reynier employs a liquid mixture of salol and iodoform in the treatment of abscess-cavities, bone-cavities, and fistulæ. Salol mixed with iodoform is liquefied under the influence of heat, but the mixture solidifies when it cools. When injected into a cavity, the mixture remains liquid and causes the gradual evacuation of the pus.[2]

Reynier makes use of the same preparation in the treatment of laparotomy wounds.

In fermentative disorders of the stomach (dilated stomach especially), in intestinal dyspepsia, salol, in 0.13 to 0.32 Gm. (or gr. ii-v) doses, is remarkably effective in relieving the annoying symptoms of flatulence, pyrosis, pain, sick headache, etc. In duodenal catarrh, or catarrh of the bile-ducts, with or without jaundice, good results are obtained from salol. Salol is regarded by Strizower as an excellent remedy in the treatment of cholelithiasis. It is said to favor the escape of calculi and retard their development. It is not given for the purpose of relieving colic, but in the intervals of attacks,

[1] *American Journal of Pharmacy*, Jan., 1891.
[2] *La Médecine Moderne*; *Medical Bulletin*, Sept., 1893.

in doses of 0.65 Gm. (or gr. x) three or four times a day. It has been employed as a *succedaneum* for salicylic acid in diabetes.

This substance is of value in diarrhœa, and is strongly recommended by Moncorvo, of Rio Janeiro, in the malarial diarrhœa of children.

The following prescriptions containing salol are useful:—

℞ Phenylis salicylatis ..... 8| Gm. or 3ij.
Pulv. ipecacuanhæ et opii ..... 1|55 Gm. or gr. xxiv.
M. et ft. chartulæ no. xl.
Sig.: A powder every hour or two until relieved of diarrhœa.

℞ Phenylis salicylat
Bismuth. subnit.,
Cretæ præparatæ ..... aa 4| Gm. or 3j.
M. et ft. chartulæ no. xij.
Sig.: A powder every hour or two, for diarrhœa.

℞ Phenylis salicylat..... 8| Gm. or 3ij.
Bismuth subnitrat. ..... 4| Gm. or 3j.
Misturæ cretæ .....q. s. ad 90| c.cm. or f℥iij.
Sig.: Dessertspoonful every two hours until relieved.

Cholera infantum, the diarrhœa of tuberculosis and of typhoid fever are also benefited by phenyl salicylate. Dr. W. L. Carr has found it of decided service in the first stage of acute gastro-enteritis. In doses of 0.25 Gm. (or gr. iv), suspended in mucilage, Drs. Lardier and Pernet have given salol with advantage in dysentery. Good results have been reported by several observers from the use of this remedy in Asiatic cholera. If seems very apt, however, to increase the gastric disturbance which accompanies cholera and, as shown by the case cited by Girode, this remedy should be used with great caution in ulcerous conditions of the alimentary tract.

Salol, being excreted as salicylic acid, acts as a disinfectant to the urinary passages, and is useful in pyelitis, catarrh of the bladder, and ammoniacal urine. Dr. S. L. Abbott treated three cases of cystitis in women with salol (0.65 Gm., or gr. x, thrice daily, or 0.32 Gm., or gr. v, every three hours). Under its use the symptoms disappeared and the urine became acid, and the patients were cured after the failure of other remedies. Testimony to the same effect is given by Arnold, who remarks that it has afforded relief even in cases of tuberculous cystitis.

In pulmonary tuberculosis, Grossi makes use of a solution of 1 part of salol in 3 parts of almond-oil, subcutaneously injected. M. Heiz reported twenty cases of blennorrhagia treated by salol, in which the disease lasted only ten or twelve days. In the same communication[1] he praises it highly in typhoid fever, giving it in doses of 4 Gm. (or ℥j) daily, combined with bismuth salicylate. In a series of forty-nine cases of typhoid fever treated by Posajnyi by salol, all of which were severe, the remedy produced marked amelioration in 75 per cent., while in the remaining cases it produced no good effect. In about one-fourth of the number the diarrhœa ceased after one or two days' exhibition of the drug, and in some cases was succeeded by constipation. Salol is especially valuable in the treatment of acute rheumatism, given in 1 to 2 Gm. (or gr. xv-xxx) doses, three or four times daily. It reduces the temperature and causes free perspiration, and is somewhat analgesic. It is, however, less acceptable to the digestive organs than salicin.

[1] *Répertoire de Pharmacie*, July 10, 1890.

M. Gouguenheim says that phenyl salicylate has a very manifest action in suppurative sore throat (tonsillitis, etc.). It is valuable as an intestinal and urinary antiseptic. It is especially serviceable in cystitis, enlarged and irritable prostate, gonorrhœa, and gleet. In the treatment of diseases of the genito-urinary tract, salol can be prescribed as follows:—

℞ Phenylis salicylat., ... 6|50 Gm. or gr. c.
Terebeni ..... 6|20 c.cm. or *mc.*

M. et ft. capsulæ no. xx.
Sig.: A capsule or two every two or three hours. For irritation of the genital organs. Valuable especially in gleet.

The following have also proved of service in gonorrhœa and gleet:—

℞ Phenylis salicylat. ..... 6|50 Gm. or gr. c.
Ext. belladonnæ folior ..... |13 Gm. or gr. ij.

M. et ft. capsulæ no. xx.
Sig.: From four to six capsules a day.

℞ Phenylis salicylatis ..... 6|50 Gm. or gr. c.
Ext. ergotæ ..... 1|30 Gm. or gr. xx.

M. et ft. capsulæ no. xx.
Sig.: One or two capsules every two or three hours. For cystitis and in enlarged prostate.

Dr. J. William White[1] recommends salol, given in capsules, as follows in the treatment of recent anterior urethritis:—

℞ Phenylis salicylatis ..... |23 Gm. or gr. iiiss.
Oleoresin. cubebæ ..... |30 c.cm. or *mv.*
Copaibæ (Para) ..... |60 c.cm. or *mx.*
Pepsini ..... |065 Gm. or gr. j.

M. et ft. capsulæ no. j. Mitte no. xxx.
Sig.: One capsule four to six times daily.

White reported that the discharge thus treated, in two-thirds of the cases, ceased within a week. In the majority of patients he also recommended an injection of 0.13 Gm. (or gr. ij) of zinc sulphocarbolate in a 10- to 15-per-cent. solution of hydrogen dioxide.

Grautzoff, in addition to its internal administration in gonorrhœa, employs it as an injection according to the following formula:—

℞ Phenylis salicylatis ..... 10| Gm. or 3iiss.
Pulv. acaciæ ..... 5| Gm. or gr. lxxv.
Aq. destillat. .....1892| c.cm. or Oiv.—M.

Nicolaier has obtained satisfactory results in six cases of diabetes mellitus from the use of salol, giving 2 Gm. (or gr. xxx) three times a day. An improvement generally resulted within eight days. In some of the cases the diet was not restricted, and this writer particularly recommends salol where an antidiabetic regimen is, for any reason, impracticable. Lutz advocates the employment of salol in tuberculosis, and claims that it possesses special value in acute phthisis. He is of the opinion that the drug diminishes the disintegration of tuberculous material.

Salophen, or Acetpara-amidosalol, crystallizes in fine, white scales. It is almost insoluble in water, readily soluble in alcohol and ether, and is desti-

[1] *The Philadelphia Medical News*, June 14, 1890.

tute of taste or odor. It contains 51 per cent. of salicylic acid. Upon being heated with soda-lye, it is split up into sodium salicylate and acetyl-para-amidophenol. This decomposition takes place also within the organism. The substance is not acted upon by the acid gastric juice, but decomposition takes place within the intestine. No deleterious by-effects have yet been observed from its use. It is regarded as of special value in the treatment of debilitated patients. Salophen is claimed to be much less toxic in its effects than salol. It can be administered to animals in the average quantity of 0.20 Gm. (or gr. iij) to the pound of body-weight. Salophen can be safely given to men, according to the investigations of P. Guttmann, in daily doses of 6 to 8 Gm. (or 3iss-ij). Salophen is excreted by the fæces and also by the skin. After evaporation of the perspiration, crystals of salophen or of a product of its decomposition have been observed upon the skin by Professor Drasche, of Vienna. The surface glittered as if sprinkled with diamond dust. Dr. Hirschmann found that the administration of several other bodies belonging to the aromatic series (as sodium salicylate, acetanilid, and phenacetin) was followed by an elimination in crystalline form. This result was noticed particularly after the use of phenacetin. An abundance of beautifully-formed crystals was found upon the skin after the administration of 1 Gm. (or gr. xv) daily for three days.

Guttmann found salophen to have a favorable action in acute rheumatism, in some instances diminishing pain and swelling within a few days. Other cases, however, demanded weeks and months for their cure. It is unable to prevent relapse or extension to previously unaffected articulations. Later observers have substantially confirmed this judgment. In chronic rheumatism it will generally alleviate pain, but does not promote absorption of periarticular exudations, nor does it prevent the cardiac complications of the disease.

Salophen appears to be well adapted for use in diseases of children. It has been administered with advantage in scarlatina, typhoid fever, pneumonia, and tuberculosis. The antipyretic power of salophen is but slight. In typhoid fever from 4 to 6 Gm. (or 3i-iss) is needed in order to reduce the temperature 1° to 1 $^1/_2$° C. In phthisis the exhibition of 3 to 4 Gm. (or gr. xlv-lx) causes a reduction. In two cases of cystitis the late Dr. Guttmann saw no improvement after administering this drug. Salophen has generally proved beneficial in neuralgia and, according to the studies of Dr. Edmund Koch, has an excellent analgesic effect in the most diverse nervous disorders. Salophen is particularly available in neuralgia dependent upon a rheumatic diathesis. On account of its value as an intestinal antiseptic it has been proposed to make use of salophen in cholera.

Salacetol has been introduced as a substitute for salol, and is claimed to be free from the toxic properties of the latter. Salacetol is obtained by heating monochloracetone with sodium salicylate. It crystallizes from alcohol in the form of scales or lustrous needles. It is but slightly soluble in hot or cold water, but dissolves in hot alcohol, ether, chloroform, carbon disulphide, benzol, and benzin. Its taste is slightly bitter and it melts at 160° F. Salacetol is broken up in the intestine into salicylic acid and acetol, the latter body being eliminated in the urine in the form of acetone. Salacetol is unchanged in passing through the stomach. The absorption of salacetol is promoted by the conjoined exhibition of castor-oil. The dose for an adult is from 2 to 3 Gm. (or gr. xxx-xlv) and children can take

0.10 Gm. (or gr. iss) for each year of their age. When incorporated with lard it is absorbed by the skin.

The virtues of salacetol have been studied by MM. Bourget and Barbey. They esteem it an excellent intestinal antiseptic and have given it with advantage in choleraic diarrhœa. The administration of salacetol in acute articular rheumatism causes a rapid decline of temperature and amelioration of pain. At the same time the writers quoted recommend an application to the joints composed of:—

℞ Acid. salicylic.,			
Adipis lanæ hyd.	aa 10	Gm.	or 3iiss.
Ol. terebinth.	9 25	c.cm.	or f3iiss.
Adipis	93	Gm.	or ʒiij.—M.

Salacetol has likewise produced good results in chronic and muscular rheumatism and, given in castor-oil, has been beneficial in cases of biliary lithiasis.[1]

SALVIA (U. S. P.).—**Sage.**

Dose, 0.65 to 2 Gm. (or gr. x-xxx), in infusion or fluid extract (with diluted alcohol).

Pharmacology.—"The dried leaves of Salvia officinalis" (Labiatæ), a garden herb, used for its flavor in cooking. The leaves should be picked by hand and carefully dried in the shade if intended to be used for medicinal purposes. It contains from $^1/_2$ to $^3/_4$ per cent. of volatile oil, **Oleum Salviæ,** with tannin, resin, etc.

Physiological Action.—The infusion (25 per cent.), of which the dose is from an ounce to a wineglassful, is tonic, astringent, and stimulant. The latter quality is increased in the fluid extract by the diluted alcohol, used as a menstruum. MM. Cadéac and Albin have demonstrated that the oil of sage gives rise to epileptiform convulsions in the dog.

Therapy.—Infusion of sage by itself is a very good gargle and astringent wash for the nose or mouth. Internally it has been administered for its tonic effects in fevers, and to check sweating, especially in phthisis pulmonalis. Sage may be combined with other remedies as an injection for urethritis or vesical catarrh. The compound sage-gargle consists of:—

℞ Aluminis	15 5	Gm.	or 3iv.
Salviæ	31	Gm.	or ʒj.
Mel despumati	60	c.cm.	or f3ij.
Aquæ bullientis	473	c.cm.	or Oj.

Ft. infusum et cola.
Sig.: Dilute with water and use as a gargle.

The infusion is also popularly used as an application to the scalp, and to darken the hair.

SAMBUCI FLORES (B. P.).—**Elder-flowers.**

Dose, 15.5 to 31 Gm. (or ʒss-j), in infusion, drunk while hot.

Preparation.

Aqua Sambuci (B. P.).—Elder-flower Water (a distilled aromatic water).

[1] *Therapeutische Monatshefte,* Dec., 1893.

Pharmacology.—"The flowers of Sambucus nigra, separated from the stalks" (B. P.), the common European black elderberry. In this country, the dried flowers of Sambucus canadensis (Caprifoliaceæ) were official in the preceding edition of the Pharmacopœia. The flowers are sometimes used for flavoring purposes. They contain a small proportion of a volatile oil, which has the fragrant odor of the flowers in a high degree; also valerianic acid, acrid resin, and mucilage.

Physiological Action.—Elder-flower water, aqua sambuci (B. P.), when freshly distilled, is a good vehicle for lotions and eye-washes. In hot infusion, sambucus acts as a stimulant, diuretic, and diaphoretic, and may be emetic if given in too large quantity. The ripe berries are edible, and the juice is considered antiscorbutic and alterative; it is used in rheumatism and syphilis. Elder-berry jam or conserve may be used as a food; it is slightly laxative. The inner bark of elder is cathartic, and, in large doses, emetic.

The physiological properties of elder-bark have been studied by Combemale. Large doses of the decoction of the outer bark or of the whole bark produced decided polyuria in dogs. Moderate doses gave rise to no considerable increase of urine, but the temperature was lowered and the pulse and respiration retarded. The decoction of the fresh inner bark was strongly diuretic. Large doses acted very rapidly, and the effect continued for more than five hours. In the meantime, the temperature, after first rising slightly, sank to a tenth below the normal. The pulse also gradually became more slow. A maceration of the inner bark exerted much less influence upon the kidneys, but occasioned nausea and vomiting, with subsequently a severe diarrhœa, associated with reduction of the temperature and retardation of the pulse. A rabbit died after the injection of a large quantity of the whole bark. The autopsy showed intense injection of all the organs, with pulmonary hæmorrhages.

Therapy.—Dr. George Lemoine employed a decoction of the fresh inner bark therapeutically. Increased diuresis continued as long as the drug was used. The best effect was obtained in acute nephritis, and the drug is capable of good service in ascites and œdema. In two cases an acute eruption upon the skin occurred while elder-bark was being taken: in one case of small furuncles, in the other an urticaria. (Possibly the remedy may have been accidentally mixed with swamp-sumach.)

SANGUINARIA (U. S. P.).—**Blood-root.**

Dose, 0.13 to 1.30 Gm. (or gr. ii-xx).

Preparations.

Tinctura Sanguinariæ (U. S. P.).—Tincture of Sanguinaria (10 per cent.). Dose, 0.60 to 4 c.cm. (or *m*x-f3j).

Fluidextractum Sanguinariæ (U. S. P.).—Fluid Extract of Sanguinaria. Dose, 0.20 to 0.30 c.cm. (or *m*iii-v). (In the last edition of the United States Pharmacopœia, the menstruum of the fluid extract was changed to acetic acid and water.)

Acetum Sanguinariæ. — Vinegar of Sanguinaria. Dose, 1 to 2.50 c.cm. (or *m*xv-xl); as an emetic, 4 to 18.5 c.cm. (or f3i-v).

Pharmacology.—"The dried rhizome of Sanguinaria canadensis (Papaveraceæ), collected after the death of the foliage," is about two inches long, cylindrical, reddish brown, containing small, red resin-cells; taste,

very bitter and acrid. It contains five alkaloids, **Sanguinarine, Chelerythine,** β and γ-**homochelidonine,** and **Protopine,** with citric and malic acids. As separated by König and Tietz, sanguinarine is a colorless, crystalline substance, soluble in alcohol and chloroform. Its salts are of a blood-red color. The commercial Sanguinarine nitrate is said by Schlotterbeck to be not a pure article, but to consist of chelerythrine instead.

Physiological Action.—The powder is extremely irritating to the air-passages, causing violent sneezing and free secretion. It is a feeble escharotic. The taste is harsh and bitter. Taken internally, it is a systemic emetic, its action being followed by salivation and much depression, causing also an increase of hepatic secretion. Sanguinaria may cause hypercatharsis and act as an irritant, acro-narcotic poison. It is emmenagogue and expectorant, and, after a preliminary increase of arterial tension, depresses the heart's action; death is produced by paralysis of the medullary, respiratory, and cardiac centres. The spinal reflexes are reduced and spinal centres finally paralyzed; the pupils become dilated, the muscles relaxed, the skin cold and clammy, with collapse of the vital powers; the fatal result often is preceded by convulsions, either of spinal origin or arising from carbonic-acid poisoning, due to failure of respiration.

Antidote.—The antidotes are diffusible stimulants,—digitalis, amyl nitrite, strychnine hypodermically, with morphine and atropine, if necessary, to relieve pain or severe nausea. The patient should be kept warm, artificial respiration be maintained, and warm water may be used to wash out the stomach and bowels.

Therapy.—Blood-root has been used in powder as an application to ulcerated surfaces, and is regarded by some as a cure for cancer; but it is painful, and, if freely applied, may be absorbed and cause vomiting and other symptoms of poisoning. Keyser employed sanguinarine nitrate (Merck's) 0.015 Gm. (or gr. $^1/_4$), with 30 c.cm. (or f℥j) of glycerin, as a remedy for conjunctivitis granulosa. Powdered sanguinaria, snuffed or blown into the nose, properly diluted, excites secretion in chronic rhinitis. A decoction has been used popularly as a gargle in scarlatinal angina. An ointment containing blood-root has been successfully used in tinea. The powdered root is recommended by some as a sternutatory in nasal catarrh, and the treatment may be considered effective, because the patient will not be likely to return for further treatment. The conjoined internal use of the tincture—dose, 0.60 c.cm. (or *m*x), thrice daily—is also advised. In small doses of the tincture (5 or 10 drops several times a day), it is considered valuable in atonic dyspepsia, gastric catarrh, or duodenal catarrh with jaundice. Large doses, a teaspoonful to a tablespoonful of the vinegar, or the tincture, causes vomiting, with increase of hepatic secretion. It has been used in croup as an emetic, but is too violent and too depressing.

In various spasmodic affections and disorders, accompanied by cough, as in pneumonia, asthma, bronchitis, etc., small doses of the tincture may be given at short intervals. Sanguinaria may be prescribed thus with expectorants for the diseases referred to:—

℞ Tinct. sanguinariæ	4	c.cm. or f℥j.
Syrupi ipecac.	15	c.cm. or f℥ss.
Tinct. lobeliæ	4	c.cm. or f℥j.
Glycerini	15	c.cm. or f℥ss.

M. Sig.: A teaspoonful every two or three hours, for subacute bronchitis.

℞ Tinct. sanguinariæ ..... 7|5 c.cm. or f3ij.
Ammonii bromidi ..... 12| Gm. or 3iij.
Spiritus ætheris nitrosi ..... 30| c.cm. or f3j.
Syrup. pruni Virg. .....q. s. ad 150| c.cm. or f3v.

M. Sig.: Two teaspoonfuls in water every two or three hours, for asthma and in bronchitis.

Sanguinarine may be given as an expectorant in doses of 0.005 to 0.008 Gm. (or gr. $^1/_{12}$-$^1/_8$) in pneumonia, bronchial catarrh, winter cough, etc., the alkaloid having the advantage of not disturbing the stomach, although its secretions are increased by fractional doses. A syrup of sanguinaria, made by adding sugar to the vinegar, may be used as an ingredient in cough-mixtures.

In hysteria, due to pain or moral causes, sanguinaria is said to be sometimes of advantage, either given alone or in combination with podophyllum.[1] For various functional affections of the genital system, amenorrhœa, dysmenorrhœa, and in impotence, with seminal incontinence and relaxation of the organs, sanguinaria is pronounced a serviceable remedy. Blood-root can be combined as follows, for the diseases named:—

℞ Tinct. sanguinariæ,
Tincturæ nucis vomicæ,
Fluidext. ergotæ ..... aa 7|5 c.cm. or f3ij.

M. Sig.: Twenty to forty drops in water three times a day, in amenorrhœa; useful also in impotence and seminal weakness.

℞ Sanguinarinæ,
Aloini,
Ext. ignatiæ..... aa |13 Gm. or gr. ij.
Ferri lactatis ..... 1|30 Gm. or gr. xx.

M. et ft. pil. no. xx.

Sig.: A pill three or four times a day; beneficial as an emmenagogue and in genital debility.

Sanguinaria is also regarded as an alterative, on account of its influence upon secretions, and may be used in syphilis, especially of the skin.

SANTALI OLEUM (U. S. P., B. P.).—**Oil of Sandal-wood.** (See **Oleum Santali.**)

SANTALUM RUBRUM (U. S. P.), **PTEROCARPI LIGNUM** (B. P.).—**Red Saunders, Red Sandal-wood.**

Pharmacology.—"The heart-wood of Pterocarpus santalinus" (Leguminosæ) usually is met with in the shops as raspings. It contains a red coloring matter of a resinous character, **Santalin** or **Santalic acid**, which is soluble in alcohol, but insoluble in water. It also contains **Pterocarpin**, tannin, etc. Red saunders is used in pharmacy for coloring alcoholic liquors or tinctures. It enters into the compound tincture of lavender. It has no medicinal qualities.

SANTONICA (U. S. P.).—**Santonica, Levant Wormseed.**
Dose, 0.20 to 1 Gm. (or gr. iii-xv).

SANTONINUM (U. S. P., B. P.).—**Santonin.**
Dose, 0.13 to 0.32 Gm. (or gr. ii-v).

Preparation.

Trochisci Santonini (U. S. P., B. P.).—Troches of Santonin, Worm Lozenges (each 0.03 Gm., or gr. ss. The B. P. troches contain 0.065 Gm., or gr. j).
Oleum Santonini.—Oil of Santonin.

[1] Phillips, *op. cit.*

Pharmacology.—"The dried, unexpanded flower-heads of Artemisia pauciflora" (Compositæ), growing in Turkestan and surrounding countries, are known as Levant wormseed. They contain 2 to 3 per cent. of volatile oil and from $^1/_2$ to 2 per cent. of **Santonin** and **Artemisin** (Oxysantonin). Santonin, when warmed with alkalies, is changed into Santoninic Acid, of which the sodium salt was formerly official. Santonin is described (U. S. P.) as "the inner anhydride or lactone of santonic acid, obtained from Santonica; or (B. P.), as "a crystalline principle derived from the dried unexpanded flower heads or capitula of Artemisia maritima var. Stechmanniana, Besser. As the object of administration of this remedy is to act locally upon the parasites of the digestive tract, it is better to use the troches, made with santonin, instead of sodium santoninate, because less likely to occasion toxic effects. Santonin dissolves with difficulty in cold water. It is soluble in 250 parts of boiling water, readily soluble in alcohol, chloroform, and alkaline solutions, moderately soluble in ether, and insoluble, or nearly so, in glycerin.

Physiological Action.—Santonin is a very popular vermifuge against the round-worm, *Ascaris lumbricoides*, and, to a less extent, against the thread-worm, *Oxyuris vermicularis*. It has no effect upon the tape-worm. The crystals of santonin are colorless, but turn yellow upon exposure to light. This effect is due to a partial change in its composition. Colored santonin is an unreliable remedy. When taken into the body, the same change occurs in the blood, which disturbs the nutrition of the cerebral centres, so that chromatopsia is produced, the patient complaining that everything has a lurid, yellow or greenish tinge, and he may even entirely lose his vision for a few days. In exceptional instances the color perceived was red or blue.

The urine is stained a greenish-yellow, or, if it should be alkaline, it has a reddish-purple color. This is due to **xanthopsin**, a derivative of santonin.

Elimination, which takes place by the kidneys, is slow, about two days being required for the removal of an ordinary dose. The flow of urine is considerably increased, and the calls for micturition are frequent. Acute poisoning sometimes occasioned by children eating worm-candy, or lozenges, is manifested by cerebral and digestive disorder and muscular prostration, with tremors, or even convulsions. Death occurs from respiratory failure. Urticaria has been caused by its prolonged administration. A case of urticaria has been reported as due to a single 0.20 Gm. (or gr. iij) dose given to a child. In the case of a man 0.32 Gm. (or gr. v) caused, within three hours, "a general morbilloid eruption and an intense punctiform rash on the mucous membrane of the mouth and throat."[1]

The treatment of poisoning, having first cleared the intestinal canal by a cathartic, is by diffusible stimulants, a hot bath, demulcent drinks, belladonna, and strychnine, with ether or chloroform to control convulsions.

Therapy.—Dr. G. Frank Lydston[2] says that he has found a substitute for bromides in the treatment of epilepsy in santonin, which he has used for nearly twenty years in the treatment of this affection. Santonin is a valuable antispasmodic in children. He claims that under it the

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[1] *The National Dispensatory*, fifth edition, p. 1415.
[2] *Therapeutic Gazette*, Feb. 15, 1900.

average epileptic patient shows better results than under the bromides. Santonin acts well in cases in which the bromides for one reason or another are not tolerated. It has proved of especial value in those cases in which the bromides failed. It does not cause mental hebetude, nervous or circulatory disturbances, nor disfiguring eruptions. In adults, he begins with a dose of from 0.13 to 0.32 Gm. (or gr. ii-v) of the powdered drug. The point of saturation of the system is shown by a yellow color of the urine and a varying degree of renal and vesical irritation. Caution should be exercised in giving the drug, to begin with small doses, very gradually increased. Dr. C. Negro, of Turin, has recently met with success in combating the painful crises of locomotor ataxia with santonin. For this purpose a dose of 0.40 (or gr. vj) may be given at intervals of three or four hours.

In case children show symptoms of intestinal irritation, suggesting worms, the discharges from the bowels, each day, should be watched in order to detect the presence of parasites, and this may be assisted by a saline purgative, such as magnesia, or rhubarb and magnesia, which removes the mucus in which worms breed. Then a dose of santonin should be given at night and followed by a purgative in the morning.

℞ Santonini	20 Gm. or gr. iij.
Hydrarg. chloridi mitis	38 Gm. or gr. vj.
Sodii bicarb.	75 Gm. or gr. xij.

M. et div. in chartulæ no. vj.
Sig.: Give one each night to a child 6 years old.

Given as an anthelmintic, santonin in crystals, should be given on a fasting stomach; a dose of calomel should be given 4 to 6 hours later, and this followed in 2 hours by a saline.

Rex[1] gives the following prescription, containing santonin, for lumbricoid worms:—

℞ Santonini	50 Gm. or gr. viij.
Fluidext. spigeliæ et sennæ 30	c.cm. or f℥j.

M. Sig.: One teaspoonful three times a day. Shake the mixture before measuring the dose.

In color-blindness, santonin has been tried with asserted success, but is probably of no service in the congenital form, though it might be serviceable where vision has been impaired or the appreciation of color lost by accident or disease. It has been advocated as a remedy for some disorders of the optic nerve, but without clinical evidence to support the suggestion. Nocturnal enuresis occasionally yields to santonin after the failure of other remedies. By Mr. Whitehead, of Manchester, santonin is recommended in amenorrhœa, especially when that condition is dependent upon chloranæmia. Dr. Cadogan Masterman reported a case in which this method of treatment was serviceable in severe uterine colic arising from suppression of the menses. The administration of the remedy was soon followed by the occurrence of the catamenia and relief of pain.

It should be given cautiously to feeble children, and be followed in a few hours by a dose of magnesia or rhubarb. Some practitioners prefer to administer santonin with castor-oil, and, in the experience of Dr. Whitla, this combination is of decided value in diminishing the danger of any ill

[1] *The College and Clinical Record*, Feb., 1891.

effects. Professor Demme was accustomed to administer santonin in castor-oil, but, as a rule, he preferred to give it in a slightly sweetened oleaginous solution, 0.03 Gm. to 30 c.cm. (or gr. ss-f℥j) of olive-oil, believing it to be more efficacious in this form than in that of powder.

Santoninoxime (obtained by heating five parts of santonin with four of hydroxylamine hydrochloride and lime in the presence of alcohol) occurs as white crystals, insoluble in cold water, slightly soluble in boiling water, soluble in alcohol and acetic acid. It is considered less toxic than santonin, and may be administered in doses two or three times as large.[1] As an anthelmintic, the dose for a child from 2 to 3 years old is 0.048 Gm. (or gr. $^3/_4$); from 4 to 6 years, 0.10 Gm. (or gr. iss); from 6 to 9 years, 0.13 Gm. (or gr. ij); adults, 0.32 Gm. (or gr. v), divided into two doses, taken at intervals of an hour or two and followed by a cathartic.

SAPO (U. S. P.), **SAPO DURUS** (B. P.).—**Hard Soap.** Soap prepared from sodium hydroxide and olive-oil.

SAPO MOLLIS (U. S. P., B. P.).—**Soft Soap.** Soap prepared from potassium hydroxide, linseed-oil, alcohol, and water (U. S. P.); potassium hydroxide and olive-oil (B. P.). Sapo viridis—green soap (U. S. P., 1880).

SAPO ANIMALIS (B. P.).—**Curd-soap.** Soap made with sodium hydroxide and a purified animal fat, consisting principally of stearin, containing about 30 per cent. of water.

Preparations.

Linimentum Saponis Mollis (U. S. P.).—Liniment of Soft Soap[2] (green soap, 65; oil of lavender, 2; alcohol and water, q. s. ad 100 parts). For external use.

Emplastrum Saponis (U. S. P., B. P.).—Soap Plaster (soap, 10; lead plaster, 90 parts, U. S. P. The B. P. contains soap, 15; lead plaster, 90; resin, 2 $^1/_2$ parts).

Linimentum Saponis (U. S. P., B. P.).—Soap Liniment (U. S. P. contains soap, 7; camphor, 4.5; oil of rosemary, 1; alcohol, 75; water, q. s. ad 100 parts).

Linimentum Potassii Iodidi cum Sapone (B. P.).—Liniment of Potassium Iodide with Soap (contains curd soap, 40 Gm., or 3x $^1/_3$; potassium iodide, 30 Gm., or 3viiss; glycerin, 20 c.cm., or f3vss; oil of lemon, 2.5 c.cm., or *m*xxxviij; distilled water, 200 c.cm., or f℥vif3v).

Pharmacology.—Soap may be either hard or soft. The combination of soda and fatty acids makes a hard soap; potassa makes a soft or jelly-like soap. The combination of potassium hydroxide with linseed oil is official as soft or green soap, although brownish-yellow rather than green. The soft soap, of the British Pharmacopœia, is made with olive-oil with an excess of potassa. Even hard soap usually retains considerable water when cut into bars, and, as this evaporates, the soap shrinks and becomes wrinkled and hard, so that it may be powdered. Old Castile soap is a good excipient for pills, especially cathartic masses, and enters into compound extract of colocynth (curd soap, B. P.), pills of asafetida, of aloes and asafetida, of opium, and of rhubarb. Nearly all soaps are palmitates or oleates of sodium or potassium, or a combination of them. These fatty acids may also combine with other bases, as in the lead soap, **emplastrum plumbi**, and

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[1] *Répertoire de Pharmacie*, 1890; *Journal de Médecine de Paris*, Nov. 16, 1890.

[2] Also known as Spiritus Saponis Kalinus of Hebra.

lime soap, **linimentum calcis.** Soap also enters into the U. S. P. chloroform liniment.

Physiological Action.—Soap is a useful detergent, removing grease from the skin, together with dirt, foreign matter, bacteria, and epithelial scales. In antiseptic surgery the field of operation is usually first washed with soap and water and afterward with disinfectants. Taken internally, soap is a laxative and is an antidote to acid and corrosive poisoning. In the form of soap plaster, it is a good protective for the prevention of bed-sores. Applied to raw surfaces, soap augments secretions and keeps up discharge; soap and brown sugar form a stimulating dressing. Soap acts an an alkali internally and affords relief in cystitis, and was formerly vaunted as a specific for stone in the bladder, but it has been proved that this claim was not well founded. Suppositories made with soap and glycerin are very convenient for the purpose of unloading the rectum, and small suppositories of soap will relieve infantile constipation. In the treatment of diseases of the skin, the author has witnessed signal benefit from the judicious employment of medicated hard soap. It is prudent to begin its use upon a small area, and, if it prove beneficial, it can afterward be applied to the whole of the affected area. In some instances medicated soap can be profitably used every day; in others, two or three times a week, or even less frequently. Numerous active drugs have been incorporated in soda soap.[1] Among these may be enumerated boroglyceride, carbolic acid, eucalyptol, naphtol, salicylic acid, corrosive sublimate, tar, etc. Most medicated soaps are made of 10-per-cent. strength. Some of the more active substances, as carbolic acid, eucalyptol, salicylic acid, are usually but half this strength, while 1 per cent. of corrosive sublimate is a sufficient proportion. Dr. P. J. Eichhoff has recently recommended the use of pulverulent soaps on account of the ease with which medicinal substances can be incorporated. A neutral soap is made by boiling together soda solution and beef-suet and has been placed upon the market as a fine, anhydrous, though hygroscopic, powder, which forms the basis of all the soaps and is known as neutral soap-powder base. A superfatted base is obtained by the addition of 2 per cent. of oleic acid and 3 per cent. of lanolin. By the addition of 2.5 per cent. each of potassium and sodium carbonates an alkaline soap-powder is prepared. Any one of these bases may then be medicated by the incorporation of various medicinal substances. Green soap is more decidedly alkaline, and exerts a softening effect on the tissues on account of the excess of potassa which it contains. Soap preparations are not used internally, except in cathartic pills.

Therapy.—Powdered soap is an ingredient in some dentifrices and undoubtedly helps to preserve the teeth. As an ingredient in cathartic pills, it prevents griping and is useful in ordinary constipation:—

℞ Res. podophylli	13	Gm. or gr. ij.
Ext. belladonnæ folior.	065	Gm. or gr. j.
Saponis	2	Gm. or gr. xxx.
Ol. cajuputi	24	c.cm. or *m*iv.

M. et div. in pil. no. xij.
Sig.: Take one or two at bed-time, as a laxative.

[1] For a list of medicated soaps, with a description of their composition and indications, see author's treatise on "Diseases of the Skin," fourth edition, 1901, D. Appleton & Co.

Soap-suds, made by rubbing soap in hot water, form a convenient enema for unloading the bowels; a couple of pints or more may be used, to which some castor-oil or oil of turpentine may be added. Green soap is useful in chronic induration of the skin, especially in the form of the U. S. P. official liniment, which is Hebra's spiritus saponis kalinus, and may be diluted with Cologne water (1 to 3). It is useful as a cleansing agent for the scalp in seborrhœa. In sprains, rheumatic stiffness and pains, soap liniment is very useful, and may have anodynes—like aconite, chloroform, or laudanum—added to it:—

℞ Chlorali hydrati ..... 8| Gm. or 3ij.
Lin. saponis .....150| c.cm. or f℥v.
M. Sig.: Use with friction in rheumatic pains.

Soft soap is used in chronic eczema, the best form being the official liniment, which is well rubbed into the affected area and followed by a soothing application. In psoriasis, if there be much itching, we may use the following:—

℞ Saponis mollis,
Olei cadini,
Alcoholis ..... aa 30| c.cm. or f℥j.
M. Sig.: Rub, every day or two, firmly into the patches, previously denuded of scales.

Liveing recommends the following:—

℞ Saponis mollis ..... 30| c.cm. or f℥j.
Alcoholis ..... 45| c.cm. or f℥iss.
Aquæ .....90| to 180| c.cm. or f℥iii-vj.
Solve cola et adde:—
Ol. lavandulæ florum ..... 1|20 c.cm. or *m*xx.
M. Sig.: To be rubbed in at suitable intervals and allowed to dry on, preferably at night, in chronic psoriasis, acne, tinea, and sometimes lupus. (Phillips.)

Kappesser, Senator, and others have found soft soap a useful application to enlarged glands, whether of simple inflammatory, scrofulous, or syphilitic origin. Other scrofulous or tuberculous manifestations, as disease of the mesenteric glands, periostitis, or caries, have been benefited by the same topical treatment. The same remark may be made concerning exudations into serous cavities.

A caution should be given with regard to the use of ordinary toilet soap upon delicate skins, especially in infants. Most soaps are too alkaline, and may contain irritating essential oils. Moreover, many cheap soaps are made with animal fat which has not been properly purified, and therefore they contain the bacteria of putrefaction and perhaps of disease. That vegetable-oil soap is preferable is acknowledged by the pharmacopœia, which requires it to be made with olive-oil. This is popularly called Castile soap, which may be either white or colored, the former being preferred. A good cotton-seed oil soap for the toilet or household is made also. A pure, well-made glycerin soap is probably the best for the skin, it having been made transparent usually by dissolving it in alcohol, which is afterward driven off by heat.

Sapo Kalinus Venalis, or Schmierseife, of the German Pharmacopœia, is common soft soap, made with various kinds of oil (linseed, rape, hempseed, fish, etc.). It is used in treating scabies and for clearing the skin preparatory to making applications.

SARSAPARILLA (U. S. P.).—Sarsaparilla.
SARSÆ RADIX (B. P.).—Sarsaparilla.

Preparations.

Fluidextractum Sarsaparillæ (U. S. P.).—Fluid Extract of Sarsaparilla. Dose, 2 to 7.5 c.cm. (or f3ss-ij).

Fluidextractum Sarsaparillæ Compositum (U. S. P.).—Compound Fluid Extract of Sarsaparilla (sarsaparillæ, 75; glycyrrhiza, 12; sassafras-bark, 10; mezereum, 3; glycerin, 10; alcohol and water, of each, q. s. ad 100 parts). Dose, 2 to 4 c.cm. (or f3ss-j).

Syrupus Sarsaparillæ Compositus (U. S. P.).—Compound Syrup of Sarsaparilla. Dose, 2 to 15 c.cm. (or f3ss-f℥ss).

Liquor Sarsæ Compositus Concentratus (B. P.).—Concentrated Compound Solution of Sarsaparilla (sarsaparilla, 1000; sassafras-root, 100; guaiacum-wood, 100; dried licorice-root, 100; mezereon-bark, 50; alcohol, 225 c.cm.; distilled water, q. s. ad 1000 c.cm.). Dose, 7.5 to 30 c.cm. (or f3ii-f℥j).

Extractum Sarsæ Liquidum (B. P.).—Liquid Extract of Sarsaparilla. Dose, 7.5 to 15 c.cm. (or f3ii-iv).

Decoctum Sarsaparillæ Compositum.—Compound Decoction of Sarsaparilla (sarsaparilla, 10; sassafras, guaiac-wood, and licorice-root, of each, 2; bruised mezereum, 1; water, q. s. ad 100 parts). Dose, 30 to 120 c.cm. (or f℥i-iv).

Pharmacology—The dried root of Smilax medica (Mexican, Vera Cruz, or Tampico sarsaparilla); Smilax ornata (Jamaica, Central America, or Lima Sarsaparilla); Smilax papyraceæ (Brazilian or Para sarsaparilla); or a dried root known commercially as Honduras sarsaparilla, which is probably obtained from Smilax officinalis (Liliaceæ) (U. S. P.). Smilax ornata, or so-called Jamaica sarsaparilla, is the only one recognized by the British Pharmacopœia. The roots are small, about $^1/_2$ inch in diameter, 6 or 7 feet in length; they are usually folded up into bundles about 26 inches long. They are inodorous; the taste is mucilaginous, bitter, and acrid. The flavoring known as sarsaparilla at the soda-water fountain is made from the oils of sassafras and gaultheria. Professor Kobert found four glucosides present in sarsaparilla: **Parillin, Smila, Saponin,** and **Sarsasaponin,** combined with resin ($2^1/_2$ per cent.) and traces of volatile oil. It is principally to the sarsa-saponin that Professor Kobert attributes whatever activity sarsaparilla possesses. **Smilacin,** so called, is a mixture of the glucosides.

Physiological Action.—The experiments undertaken to determine the physiological effects of sarsaparilla have yielded negative results, and deductions from the therapeutical effects are not available because it is always given with other drugs, classed by Brunton among stimulant diuretics and alteratives. It is probably inert, or nearly so, in the doses usually given, though moderate doses sometimes seem capable of improving the appetite and digestion. In much larger doses it would, probably, give the physiological effects of saponin. The chief value of the official preparations of sarsaparilla is that they are pleasant vehicles for disguising the taste of potassium iodide and of mercury, with which they are usually prescribed for syphilis:—

℞ Potassii iodidi ..... 15|5 Gm. or ℥ss.
Syr. sarsaparillæ co.,
Aquæ destillatæ ..... aa 90| c.cm. or f℥iij.
M. Sig.: A dessertspoonful in a glass of water two hours after meals in syphilitic skin affections.

Or, in the tertiary form of syphilis, we may give the recent decoction, which, if drunk hot, causes diaphoresis and diuresis, thus greatly increasing

the alterative effects. There is no evidence of a curative action of sarsaparilla by itself in syphilis; nevertheless, in debilitated subjects in whom mercury has, for a time, lost its beneficial action, or become positively harmful, a temporary recourse to sarsaparilla has been considered useful by excellent observers. Phillips believes that this remedy is serviceable in chronic pulmonary affections, where there is much wasting; in chronic rheumatism and cutaneous disorders, in which there may be suspected a venereal taint, sarsaparilla is useful. Sir Astley Cooper considered it serviceable in cachectic conditions of the system, caused by long-continued suppuration; also, in chronic abscesses, old ulcers, and bone disease. In Germany, a compound decoction containing alum, kino, calomel, senna, and aromatics (Zittmann's decoction) is used in syphilis, chronic rheumatism, and in scrofulous disorders. Sir Erasmus Wilson declared that in certain obstinate syphilitic ulcers, especially upon the mucous membrane of the tongue or mouth, he had obtained decided benefit from the administration of Zittmann's decoction after failure with mercury and iodine. The above formula is official in the German Pharmacopœia as decoctum sarsaparillæ compositum. This is a simplified formula of the ancient Lisbon diet drink, or decoctum lusitaniens.

Dr. Clark, of Youngstown, Ohio, has found the following combination useful in debilitated conditions of the system:—

℞ Syr. sarsaparill. co.	60	c.cm. or fʒij.
Fluidext. lappæ,		
Fluidext. taraxaci	aa 30	c.cm. or fʒj.
Syr. acidi hydriodici	120	c.cm. or fʒiv.

M. Sig.: Teaspoonful in water three times a day.

SASSAFRAS (U. S. P.).—**Sassafras.**

SASSAFRAS RADIX (B. P.).—**Sassafras-root.**

SASSAFRAS MEDULLA (U. S. P.).—**Sassafras-pith.**

Preparations.

Safrolum (U. S. P.).—Safrol. The methylene ether of allyl pyrocatechol ($C_{10}H_{10}O_2$).

Oleum Sassafras (U. S. P.).—Oil of Sassafras. Dose, 0.06 to 0.24 c.cm. (or *m*i-iv).

Mucilago Sassafras Medullæ (U. S. P.).—Mucilage of Sassafras-pith (2 parts in water 100).

Pharmacology.—Sassafras, "the dried bark of the root of Sassafras varii-folium, collected in early spring, or autumn, and deprived of the peridum" (Lauraceæ), U. S. P., "the dried root of Sassafras officinale" (B. P.), is common in the United States from Canada to Florida. The principal constituent of the bark is the volatile oil; it also contains tannic acid, resin, etc. The oil of sassafras is of a light-yellow color, and is a mixture of two oils, one lighter, the other heavier, than water. More than one-half of the oil (60 to 80 per cent.) is safrolum, or safrol. This is highly toxic, and acts upon the medulla, causing vasomotor paralysis. It is excreted by the kidneys as piperonylic acid. Sassafras also contains a peculiar principle, termed **Sassafrid.** Sassafras medulla, the pith of Sassafras varii-folium, contains mucilage, which is used in pharmacy as a vehicle or diluent.

Physiological Action.—The oil is stimulant and rubefacient, and, taken internally, is a carminative. It is largely used as a flavoring agent in con-

fectionery as well as pharmacy. In the experience of Dr. John Bartlett, the oil of sassafras is capable of exciting uterine contractions and causing abortion. It has been known to occasion narcotic poisoning.

Therapy.—Sassafras is an aromatic stimulant, and small bundles of the fresh bark are sold by herb-gatherers to be chewed for its flavor and as a carminative. A recent infusion is used in some parts of the country as a blood-purifier; or, taken hot, as an emmenagogue and diaphoretic. Sassafras is generally given in combination with guaiac and sarsaparilla, and in those cases where the latter agents are considered indicated. The mucilage of sassafras-pith may be used as a demulcent drink in inflammation of the stomach or bowels, especially when this has been excited by irritant or corrosive substances. It is a cooling application to inflamed eyes or erysipelas, and may be used as a vehicle for other remedies. The following is known as Jackson's Pectoral or Cough Syrup. It is the Syrupus Pectoralis of the National Formulary:

℞ Morphinæ hydrochloridi	55	Gm. or gr. viij.
Olei sassafras	5	c.cm. or *m*vij.
Syrupi Acaciæ q. s. ad	1000	c.cm. or Oij.

Each teaspoonful contains gr. $^1/_{32}$ of morphine hydrochloride.

Another formula for this syrup is given by Remington:—

℞ Ol. sassafras	4	c.cm. or *m*lxiv.
Tinct. Tolutani	240	c.cm. or f℥viij.
Magnesii carb.	62	Gm. or ℥ij.
Aquæ	3784	c.cm. or Oviij.
Sacchari	6344	Gm. or lb. xiv (avoir.).
Morphinæ hydrochloridi	4	25 Gm. or gr. lxiv.

M. Rub up the tincture and oil with the carbonate, gradually add $^1/_4$ pound of the sugar and then the water, filter and recover 8 pints, in which dissolve the remainder of the sugar. Dissolve the morphine in one fluidounce of water, add to the syrup, and make the measure up to 16 pints.

Sig.: Take a teaspoonful or more several times daily for cough (each drachm contains 0.002 Gm., or gr. $^1/_{32}$, of morphine hydrochlorate).

The **Atherosperma moschata,** or Australian sassafras, a tree of southern Australia and Tasmania, contains an alkaloid called **atherospermine** and a volatile oil, of a light-yellow color and a pleasant smell and taste, recalling that of sassafras. A decoction of the bark acts freely upon the kidneys and skin and has been used in rheumatism, secondary syphilis, and acute bronchitis. It liquefies sputum and facilitates expectoration. The physiological effects of the oil have been studied by Dr. Ralph Stockman, who found that in frogs and mammals it acted upon the central nervous system, producing at first excitement and subsequently marked depression. Respiration is retarded, and after fatal doses the heart stops in diastole. The oil also possesses antiseptic properties.

SCAMMONIÆ RADIX (B. P.).—**Scammony-root.**

SCAMMONIUM (U. S. P., B. P.).—**Scammony.**
Dose, 0.60 to 1.30 Gm. (or gr. x-xx).

Preparations.

Resina Scammonii (U. S. P., B. P.).—Resin of Scammony. Dose, 0.30 to 1 Gm. (or gr. v-xv) for an adult.

Extractum Colocynthidis Compositum (U. S. P., B. P.).—Compound Extract of Colocynth (U. S. P. contains resin of scammony, 14; aloes, 50; extract of colocynth, 16; cardamom, 6; soap, 14 parts). Dose, 0.13 to 1.30 Gm. (or gr. ii-xx).

Pilula Scammonii Composita (B. P.).—Compound Scammony Pill (scammony resin, jalap resin, curd-soap, aa 25 Gm.; tincture of ginger, 75 c.cm.). Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Pulvis Scammonii Compositus (B. P.).—Compound Powder of Scammony (scammony resin, 100 Gm.; jalap, 75 Gm.; ginger, 25 Gm.). Dose, 0.65 to 1.30 Gm. (or gr. x-xx).

Scammony is an ingredient in Pilulæ Catharticæ Compositæ and Pilulæ Catharticæ Vegetabiles (U. S. P.), and Pilula Colocynthidis Composita and Pilula Colocynthidis et Hyoscyami (B. P.).

Pharmacology.—Scammony is "a gum resin obtained by incising the living root of Convolvulus Scammonia" (Convolvulaceæ). It contains 70 to 90 per cent. of a resin, **Scammonin,** the remainder being gum, starch, and impurities. Scammony has a slightly acrid taste and a peculiar odor, which recalls that of cheese. Scammonin is a glucoside, nearly insoluble in water; soluble in alcohol, chloroform, ether, and alkaline solutions. The resin of scammony, precipitated from a strong alcoholic tincture by cold water, represents the active part of the drug, and is about twice as efficient.

Physiological Action.—This drug is an hydragogue cathartic, and also a feeble cholagogue; in large doses it causes symptoms of irritant poisoning. Absorption depends upon its intimate mixture with the alkaline bile and intestinal fluids, and for this reason the action of scammony is liable to vary in rapidity and power. Its effects are usually manifested in about four hours. It may cause cramps in the bowels, especially if given alone. It should be combined with other cathartics and aromatics.

Therapy.—In children, where active purgation is required, calomel and scammony may be given, triturated with sugar of milk. In cerebral affections and dropsies scammony is useful, especially in the form of compound extract of colocynth. It clears mucus from the intestines, and is an anthelmintic against both round worms and tape-worms. Scammony is serviceable in obstinate constipation and impaction of fæces. It is a purgative well adapted to cases of mania and hypochondriasis.

SCILLA (U. S. P., B. P.).—**Squill.**
Dose, 0.065 to 0.20 Gm. (or gr. i-iij).

Preparations.

Fluidextractum Scillæ (U. S. P.).—Fluid Extract of Squill (acetic acid menstruum). Dose, 0.06 to 0.20 c.cm. (or *m*i-iij).

Syrupus Scillæ Compositus (U. S. P.).—Compound Syrup of Squill (squill, senega, and tartar emetic). Dose, 0.60 to 4 c.cm. (or m*x*-f3j) (tartar emetic, gr. $^1/_4$ in f3j).

Acetum Scillæ (U. S. P., B. P.).—Vinegar of Squill (10 per cent.; B. P., 12 $^1/_2$ per cent.). Dose, 0.30 to 4 c.cm. (or *m*v-f3j).

Tinctura Scillæ (U. S. P., B. P.).—Tincture of Squill (15 per cent.; B. P., 20 per cent.). Dose, 0.30 to 2 c.cm. (or *m*v-xxx). B. P., 0.30 to 1 c.cm. (or *m*v-xv).

Syrupus Scillæ (U. S. P., B. P.).—Syrup of Squill (vinegar of squill with sugar). Dose, 0.60 to 4 c.cm. (or *m*x-f3j).

Oxymel Scillæ (B. P.).—Oxymel of Squill (squill, 75 Gm.; acetic acid, 75 c.cm.; distilled water, 240 c.cm.; with clarified honey, q. s. to make specific gravity of 1.320). Dose, 2 to 4 c.cm. (or f3ss-j).

Pilula Ipecacuanhæ cum Scilla (B. P.).—Pill of Ipecacuanha with Squill (compound powder of ipecacuanha, 30 Gm.; squill, 10 Gm.; ammoniacum, 10 Gm.; syrup of glucose, q. s. to form a mass). Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Pilula Scillæ Composita (B. P.).—Compound Squill Pill (squill, 25 Gm.; ginger,

20 Gm.; ammoniacum, 20 Gm.; hard soap, 20 Gm.; syrup of glucose, 20 Gm.). Dose, 0.25 to 0.50 Gm. (or gr. iv-viij).

Pharmacology.—"The bulb of Urginea maritima (Liliaceæ), deprived of its dry, membranaceous, outer scales, cut into thin slices, and carefully dried, the central portions being rejected" (U. S. P.). It should be kept in a dry place. The active principles are all glucosides: **Scillipicrin, Scilltoxin,** and **Scillin**; Scillain (Kurtz) is an amorphous, bitter powder and is probably a pure form of Scillin. It is soluble in water and alcohol, but not in ether. Squills also contain a bitter principle and a small quantity of volatile oil, with a considerable proportion of calcium oxalate and sugar.

Physiological Action.—In large doses squill is emetic and purgative; in smaller quantities, diuretic and expectorant. In excessive quantity it gives rise to severe or even fatal gastro-enteritis. Cases of poisoning by it have been reported by Orfila, Pereira, Fagge, Christison, Stevenson, and others. A carefully prepared British Pharmacopœial syrup of squills given in officinal doses has, according to Dr. Truman (*Pharmaceutical Journal and Transactions*), caused the death of two children with symptoms of heart-poisoning. Squill, according to Dr. Husemann, contains two heart poisons, scillipicrin and scillitoxin; of these the last affects the heart most strongly. In overdoses, squill is highly irritant to the kidneys, causes a diminished flow of urine, which may contain blood, or it may even suppress the secretion. Husemann states that death has been produced by the ingestion of 1.55 Gm. (or gr. xxiv). In cases of poisoning, the treatment is that appropriate to gastro-enteritis. Brunton classes scillitoxin among the cardiac tonics, as medicinal doses slow the heart and raise the arterial tension, like digitalis. When applied to the skin it is absorbed, and produces systemic effects. Elimination takes place by the bowels, kidneys, and bronchial mucous membrane. Squill has a bitter taste and feeble smell.

Therapy.—Squill is not used by itself, as an emetic, although the compound syrup, containing antimony and potassium tartrate, is sometimes used for this purpose in young children suffering with bronchitis or croup; but it is too depressing for ordinary cases. In weak heart, associated with dropsy or bronchial disorder, squill is especially useful, the vinegar of squill being a good preparation. Its diuretic action is enhanced by combination with calomel and digitalis. In ordinary catarrhal bronchitis squill is useful after the first stage has passed, and the secretions are becoming more tenacious. As the syrup contains acetic acid, it should not be prescribed with ammonium carbonate. In whooping-cough it is very serviceable. It should not be given in acute renal disease on account of causing irritation of the kidneys. This remedy has been used with advantage in cases of chronic pleurisy and pericarditis with effusion, and in cardiac dropsy.

SCOPARIUS (U. S. P.).—**Broom.**

SCOPARII CACUMINA (B. P.).—**Broom-tops.**

Dose, 0.65 to 1 Gm. (or gr. x-xv), in powder or in infusion.

Preparations.

Sparteinæ Sulphas (U. S. P.).—Sparteine Sulphate. Dose, 0.01 to 0.13 Gm. (or gr. $^1/_6$-ij).

Infusum Scoparii (B. P.).—Infusion of Broom (10 per cent.). Dose, 30 to 60 c.cm. (or f℥i-ij).

Succus Scoparii (B. P.).—Juice of Broom (from fresh tops with 25 per cent. of alcohol, 90°). Dose, 4 to 7.5 c.cm. (or f3i-ij).

Fluidextractum Scoparii.—Fluid Extract of Scoparius. Dose, 1.20 to 2.50 c.cm. (or *m*xx-xl).

Pharmacology.—"The dried tops of Cytisus Scoparius" (Leguminosæ), of Europe, contain **Scoparin,** which is a crystallizable neutral principle, and **Sparteine,** a volatile liquid alkaloid. An infusion or decoction is frequently used (1 to 16), a pint or more in divided doses being taken during the day. A fluid extract is official, as well as **sparteine sulphate,** which is given in doses of 0.0027 to 0.03 Gm. (or gr. $^1/_{24}$-$^1/_2$) hypodermically, and 0.01 to 0.13 Gm. (or gr. $^1/_6$-ij), or more, by the mouth.

Sparteine sulphate (U. S. P.) is "the sulphate of an alkaloid obtained from Scoparius." It is a crystalline powder readily soluble in water and alcohol, its solutions having a bitter taste.

Physiological Action. — No local action. Internally, broom, in large doses, excites vomiting and purging, and in smaller doses causes marked increase of urinary flow. It is asserted that **scoparin** is the agent which acts upon the kidneys, and that **sparteine** acts upon the heart as a stimulant or tonic, like scillitoxin or digitalin. Sparteine has also a decided effect upon the nerves and spinal cord, lowering reflex action, paralyzing motor nerves, reducing the electrical excitability of the vagus, and finally causing death by respiratory paralysis, both as the result of its action upon the centre and upon the muscles of respiration. The action upon the heart, due both to a nervous and muscular stimulation, is manifested soon after its administration; the pulse becomes slower at first, and, in about an hour, arterial tension is raised, lasting five or six hours. When taken regularly for a few weeks, the effects continue for several days after the remedy has been stopped.

According to the experiments of Gluzinski, the effects of sparteine are much more marked upon cold-blooded animals than mammals, and are more striking in the former when the drug is applied directly to the heart than when injected subcutaneously or into a vein.[1] Clarke found no evil results following the administration of 0.004 Gm. (or gr. $^1/_{16}$) every four hours, or as much as 0.75 Gm. (or gr. xij) in twenty-four hours, nor was there any evidence of cumulative action when it had been given for several months. Scoparius is a true diuretic, increasing both the urea and the water of the urine, being more rapid in its actions, but weaker than digitalis.

A series of experiments by Dr. David Cerna, relative to the physiological action of sparteine, demonstrated that it causes a brief period of increased muscular irritability, that it augments reflex action by a direct influence upon the spinal cord, this increase being subsequently followed by a depression, that it causes convulsions of a spinal origin and generally of a tetanic nature, that it gives rise to a primary increase in the rate and force of the heart's action, by a direct influence upon the heart, the increase being soon followed by a decrease, due to a direct cardiac action and stimulation of the cardio-inhibitory centres; it augments blood-pressure by an action on the heart and also by stimulating the central vasomotor system; subsequently the arterial pressure declines, owing to paralysis of the vasomotor

[1] *Wiener medicinische Blätter*, Dec. 26, 1889; *The Medical Bulletin*, March, 1890, p. 91.

apparatus and a depressant influence upon the heart; it exerts a direct action upon the respiratory centres; it generally proves fatal by respiratory failure.

Germain Sée asserts that sparteine strongly and promptly reduces the size of the heart in conditions of dilatation of this organ.

Therapy.—In renal inadequacy or deficiency of urine, owing to insufficient arterial tension, scoparius is an excellent remedy; also in the œdema, or dropsy, accompanying heart-lesions. This remedy should not be given during the progress of inflammation of the lungs, heart, or kidneys, but in chronic parenchymatous nephritis broom may be used with advantage. In hydrothorax and ascites, the use of broom, in conjunction with occasional doses of compound jalap powder, is very successful:—

℞ Potassii acetatis	6	Gm. or 3iss.
Aceti scillæ	15	c.cm. or f3iv.
Infus. scoparii	q. s. ad 240	c.cm. or f℥viij.

M. Sig.: Take a tablespoonful every four hours, as a diuretic.

Scoparin has also been used as a diuretic in doses of 0.50 to 1 Gm. (or gr. viii-xv) by the mouth, or 0.03 to 0.065 Gm. (or gr. ss-j) by hypodermic injection.

Sparteine sulphate is used by Germain Sée, in weak and irregular action of the heart, in doses of 0.01 to 0.015 Gm. (or gr. $^1/_6$-$^1/_4$) every four hours. It gives the best results in failure of compensation with mitral valvulitis. In irregular action of the heart this has been found specially serviceable. In cases of valvular disease, with defective compensation, Gluzinski states that small doses of sparteine sulphate (0.02 to 0.04 Gm., or gr. $^1/_3$-$^2/_3$) are more efficacious than larger quantities. In cases of weak heart-action, where it is necessary to administer an anæsthetic, sparteine sulphate (0.006 Gm., or gr. $^1/_{10}$) may be hypodermically injected before the operation, as a matter of precaution.

The author has found sparteine of service in cases of enfeebled cardiac action from structural lesions and also where the innervation of the organ was markedly disturbed. It is particularly valuable in disease of the mitral valve. In advanced stages of this affection, when dilatation has begun, marked relief follows the exhibition of sparteine. In cases of dyspnœa, palpitation, and cardiac debility arising from an excessive deposit of fat around the heart, sparteine is a valuable remedy. In dilatation resulting from valvular disease the writer has often administered the remedy by hypodermic injection. It is likewise beneficial in functional disease of the heart caused by excessive bodily or mental labor, anxiety, etc. It has also proved useful in the treatment of tobacco-heart. As sparteine increases the elimination of urea, it is beneficial in chronic parenchymatous nephritis and in preventing the development of uræmia. Its administration may be maintained for a considerable period without causing disorder of the digestive functions.

In cases needing a cardiac tonic, but where digitalis and strophanthus are not well tolerated, Dr. W. H. Thomson[1] gives:—

℞ Sparteinæ sulphatis	065	Gm. or gr. j.
Pulv. scillæ	03	Gm. or gr. ss.
Caffeinæ citratæ	10	Gm. or gr. iss.
Strychninæ	002	Gm. or gr. $^1/_{30}$.

M. et ft. capsulæ.

Sig.: Give one every two hours at first and gradually increase the interval.

[1] *Medical Record*, March 1, 1900.

In exophthalmic goitre (Graves's disease), it is claimed to relieve all the symptoms; and, given at the onset of a paroxysm of asthma (of cardiac origin?), it promptly checks it. Dr. William Evans, of this city, has published the history of a case in which the exhibition of sparteine was of decided benefit in angina pectoris. Dr. Cerna has given the drug with advantage in valvular lesions of the heart due to acute articular rheumatism, cardiac dilatation with failure of compensation, chorea associated with endocarditis, exophthalmic goitre, etc. Dr. Pawinski, of Warsaw, obtained good results from the use of sparteine in cardiac disease complicated with nervous disorders and in functional affections. Drs. M. Ball and Oscar Jennings have found the hypodermic injection of 0.01 to 0.02 Gm. (or gr. $^1/_6$-$^1/_3$) of sparteine sulphate of value in supporting the heart and system in the sudden or gradual withdrawal of morphine from those addicted to use of the narcotic. Langlois and Maurange recommend the hypodermic injection of 0.01 Gm. (or gr. $^1/_6$) of morphine and from 0.03 to 0.04 Gm. (or gr. ss-$^2/_3$) of sparteine sulphate preliminary to the administration of chloroform. In a number of cases of tremors from various causes, Dr. Charles S. Potts, of Philadelphia, has found sparteine beneficial. In the pulmonary tuberculosis of young subjects, Dr. G. Maurange has witnessed a decrease of cardiac action and improvement of the general condition result from the hypodermic injection of the following solution:—

℞ Spartein. sulphat.	20 to	38 Gm. or gr. iii-vj.
Eucalyptol. purificat.		24 c.cm. or *m*iv.
Ol. olivæ sterilisat. .....q. s. ad 100		c.cm. or f3xxvij.—M.

The sparteine is first dissolved in a minimum of water and mixed with the oil. The water is then evaporated off and the oil retains from 0.008 to 0.015 Gm. (or gr. $^1/_8$-$^1/_4$) of the alkaloid to 4 c.cm. (or f3j). Of this fluid he injects from 10 to 20 c.cm. (or *m*clx-f3vss) every day for a month. Sparteine sulphate may be of service in allaying hysterical excitement.

A yellow precipitate is formed by a combination of sparteine sulphate and sodium iodide.

SCOPOLA (U. S. P.).—**Scopola.**

Dose, 0.06 to 0.18 Gm. (or gr. i-iij).

Preparations.

Extractum Scopolæ (U. S. P.).—Extract of Scopola. Dose, 0.016 to 0.03 Gm. (or gr. $^1/_4$ to $^1/_2$).

Fluidextractum Scopolæ (U. S. P.).—Fluid Extract of Scopola. Dose, 0.06 to 0.20 c.cm. (or *m*i-iij).

Scopolaminæ Hydrobromidum (U. S. P.).—Scopolamine Hydrobromide. Dose, same as Hyoscine Hydrobromide, 0.0003 to 0.0006 Gm. (or $^1/_{200}$-$^1/_{100}$).

Pharmacology.—The dried rhizome of Scopola carniolica (Solanaceæ), yielding when assayed by official process not less than 0.5 per cent. of mydriatic alkaloids. Scopola is a European perennial herb, resembling the belladonna, but much smaller. The rhizome and leaves are sometimes used to adulterate the belladonna roots and leaves. An extract of scopola has been substituted for that of belladonna in making plasters. The fluid extract is the best preparation; and from it the solid extract is made by exposing it to heat, which drives off the alcohol and water. The

constituents are almost identical with those of belladonna-root, but the proportion of hyoscyamine is somewhat greater.

Physiological Action.—The characteristic constituent of scopola is **Scopolamine**, which is identical with hyoscine. This exists, however, in smaller quantity in the drug than the other alkaloids, **Atropine** and **Hyoscyamine**. Their action has already been given, on pages 253 and 546.

Therapy.—Scopola is used as a sedative in the insomnia of alcoholism, mania, and cerebral excitement. It has also been given to check nocturnal seminal emissions, in combination with the bromides.

The author, in a communication to the *New York Medical Journal* (October 7, 1905, page 760), reported a case of scopolamine poisoning from the mydriatic use of this drug. The patient, seen in consultation with Dr. Frank Woodbury, had used the drug for several months, while waiting for a cataract operation. On obtaining a fresh preparation, he placed a few drops of a $^1/_5$-of-1-per-cent. solution into each eye, and lost consciousness for several hours, but revived spontaneously, but for several days he had giddiness and mental confusion. In surgical practice, anæsthesia can be obtained by hypodermic injections of scopolamine (gr. $^1/_{100}$), with morphine (gr. $^1/_6$); these doses being repeated at one hour's interval previous to the operation. This method was suggested by a German physician, Dr. Schneiderlin. It has been used both alone and in conjunction with general anæsthesia with ether or chloroform. Unfortunately a number of deaths have resulted, some 28 having been put on record. Probably for many patients the dose of both drugs has been too large for safety. As preliminary to ether anæsthesia, scopolamine, alone or with a small proportion of morphine, may be very useful. Professor Ide, of Louvain, warns against a possible idiosyncrasy; while Bardet attributes accidents to variability of composition of the drug itself. Bulletin de Therapeutique, Oct. 23, 1907, p. 581.

Scopolamine hydrochloride has been introduced into ophthalmological practice, and, according to the estimate of Raehlmann, is about five times as powerful as atropine. It is used in $^1/_{10}$- to $^1/_5$-per-cent. solutions; of the latter 0.37 or 0.43 c.cm. (or *m*vi-vij) may be administered daily to an adult or used every fifteen minutes during an hour and a half. Weaker solutions are employed in the case of children. Scopolamine hydrochloride is said to produce no unpleasant after-effects or double vision, and dryness of the throat is not caused except by very large doses, but some cases have been reported in which dangerous symptoms were observed after its use as a mydriatic. Instilled into the eye, this salt has been of service in the treatment of iritis, episcleritis with infiltrations of the sclerotic, pericorneal injection, pannus, and suppurative inflammations of the anterior section of the eyeball. Raehlmann states that in five cases it caused a diminution in the size of a hypopyon. It is said that it has no influence upon intra-ocular pressure, and is especially valuable in inflammation of glaucomatous eyes. The duration of the mydriasis and the paralysis of accommodation was from twenty-four to forty-eight hours. Dr. Thomas R. Pooley, of New York, has obtained satisfactory results from the use of scopolamine (hyoscine), but has observed three cases in which it produced very marked toxic effects. Dr. Charles A. Oliver considers scopolamine (or hyoscine) hydrobromide, in plastic iritis, where quick and active measures are so necessary during the early stage, as very important, but it is less valuable in prolonged cases. In the latter class of cases, where more permanent effects are desired, he alternates its use with atropine. He

had not encountered any symptoms of poisoning, although when he had used it freely he had observed giddiness, inco-ordination of movement, and drowsiness.

SCUTELLARIA (U. S. P.).—**Scutellaria (Scullcap).**

Preparation.

Fluidextractum Scutellariæ (U. S. P).—Fluid Extract of Scutellaria. Dose, 2 to 4 c.cm. (or f3ss-j).

Pharmacology and Physiological Action.—"The dried plant Scutellaria lateriflora" (Labiatæ) has a bitter taste, and contains a little volatile oil and a bitter principle. The eclectic "**Scutellarin**" is an impure extract, probably devoid of medical qualities. It is given in doses of 0.13 to 0.25 Gm. (or gr. ii-iv). The fluid extract is esteemed to possess tonic, antispasmodic, and alterative powers, but Dr. Lawrence Johnson stated that if it possesses any valuable medicinal properties the fact remains to be demonstrated.

Therapy.—In various diseases, accompanied by twitching of the muscles, restlessness, tremors,—such as chorea, delirium tremens, epilepsy, etc.,—scutellaria has been employed, chiefly, however, in domestic practice. Its claims for usefulness in hysteria and hydrophobia are not well founded.

SECALE CORNUTUM.—Spurred Rye. (See **Ergot.**)

SEDUM ACRE.—Sedum acre (Crassulaceæ), stonecrop or wall-pepper, is a small, moss-like, spreading plant native of Europe. It grows in dry fields and on old walls, with no smell, but has a mucilaginous and acrid taste.

Physiological Action and Therapy.—The juice of the stonecrop is a decided local irritant, and is capable of blistering the skin. Taken internally, in large doses, it acts as an acrid emetic and purgative. The bruised plant, or its juice, has been used with success upon indolent or unhealthy sores and enlarged lymphatic glands. The juice has been used to remove warts or corns. Dr. Louis Duval, of Madrid, asserts that sedum is of signal service in diphtheria, made into a decoction with beer. Injection of the decoction into the nares is said to be effective in nasal diphtheria. It is claimed that this drug possesses the power of loosening the diphtheritic membrane, and that it does not form anew. These statements have been confirmed by several physicians in other European countries, and by Dr. P. O. Wagener.[1] The latter writer cannot commend the decoction in beer, but obtains the same effects from the remedy used locally, and combined as follows:—

℞ Ol. terebinthinæ,
Acid. lactici,
Fluidext. aconiti ..... aa 7|5 c.cm. or f3ij.
Fluidext. sedi acris ..... 30| c.cm. or f3j.

M. This mixture is applied with a brush, every three minutes, for twenty minutes, when vomiting occurs and the membrane is expelled.

SENECIO, the common ragwort (Senecio Jacobœa), grows wild in Europe and North America. The entire plant has been used. Grandval and Lajoux have obtained from the underground parts two alkaloids **Senecine** and **Senecionine.** These are very bitter to the taste and yield salts soluble in water.

[1] *Therapeutic Gazette,* 1885, p. 449.

Physiological Action.—Dr. J. L. Bunch[1] found that while an injection of a small dose of an alcoholic extract of the entire plant of senecio given to a dog caused a rise of general blood-pressure, with a constriction of peripheral vessels and of vessels of the intestinal area; large doses caused a fall of general blood-pressure, with dilatation of the intestinal vessels and inhibition of the contractions of the intestinal coat. Watery extracts produced a fall of blood-pressure and cardiac inhibition, due to the action of the drug on the nerve-terminations in the heart, and not to direct action on the muscular fibres of that organ.

Therapy.—The principal use of this agent has been in disturbances of the menstrual function. In amenorrhœa, Delaché and Heim used senecio in fifteen cases and found it to act prompt and well. They employed a solid extract in doses of 2.5 Gm. (or gr. xxxvij) daily. Bardet and Bolognesis used it in twenty cases of amenorrhœa and dysmenorrhœa and found that it had the constant property of provoking menstruation and to relieve the pain. Dr. William Murrell suggests that, in chlorosis complicated with amenorrhœa, it is best to treat the chlorosis, and, after the quality of the blood has been improved, to give the senecio. His usual dosage was 7.5 c.cm. (or f℥ij) of the 10-per-cent. alcoholic tincture three times a day.

Senecio has also been recommended in the impotence of the aged, but there is no conclusive evidence as to its efficacy.

SENEGA (U. S. P.).—**Senega.**

SENEGÆ RADIX (B. P.).—**Senega-root.**

Dose, 0.65 to 1.30 Gm. (or gr. x-xx).

Preparations.

Fluidextractum Senegæ (U. S. P.).—Fluid Extract of Senega. Dose, 0.60 to 1.20 c.cm. (or *m*x-xx).

Syrupus Senegæ (U. S. P.).—Syrup of Senega (fluid extract, 200; ammonia-water, 5; sugar, 700; water, q. s. ad 1000). Dose, 4 to 7.5 c.cm. (or f℥i-ij).

Liquor Senegæ Concentratus (B. P.).—Concentrated Solution of Senega (a strong tincture, 50 per cent.). Dose, 2 to 4 c.cm. (or f℥ss-j).

Infusum Senegæ (B. P.).—Infusion of Senega (5 per cent.). Dose, 15 to 30 c.cm. (or f℥ss-j).

Tinctura Senegæ (B. P.).—Tincture of Senega (20 per cent.). Dose, 2 to 4 c.cm. (or f℥ss-j).

The U. S. P. official compound syrup of squill contains 8 per cent. of fluid extract of senega.

Pharmacology.—"The dried root of Polygala Senega" (Polygalaceæ) is a knobby root-stock, with spreading, tortuous rootlets, twisted and keeled. It grows in the United States, especially in the South. The active principles, contained especially in the cortex, are **Senegin** and **Polygalic acid,** forming a mixture apparently the same as saponin from saponaria, the two bearing similar relations to those of quillajic acid and quillajasapotoxin in quillaja-bark. It is a white powder, easily soluble in hot water and alcohol, forming a soapy emulsion when mixed with water, even in small quantities. The fluid extract is made with an alcoholic menstruum, to which is added solution of potassium hydroxide (3 per cent.).

Physiological Action.—Senega is irritating to the air-passages and causes sneezing when inhaled. The root, when chewed, gives rise to a burn-

[1] *British Medical Journal*, July 28, 1900.

ing sensation. When swallowed in large doses, senega excites salivation and gastro-intestinal and renal irritation. It is likewise irritant when applied to the integument. It is a stimulating expectorant, diuretic, and diaphoretic. It does not liquefy the secretions of the bronchial tubes, but simply facilitates their expulsion. When the expectoration is tough and scanty, senega is of little use. It is usually given in combination with other expectorants and diuretics. Senega is excreted by the bronchial mucous membrane, skin, and kidneys, exercising upon these organs a stimulating action.

Therapy.—Senega is useful in the second stage of bronchitis, or pneumonia in the stage of resolution. In chronic bronchitis, associated with emphysema and occurring in aged people, it will often answer a good purpose. By some practitioners it is esteemed beneficial in croup. In bronchial asthma with emphysema this remedy is likewise of considerable efficacy. Whooping-cough is sometimes ameliorated by the administration of senega. In dropsy, accompanying renal disease, it is useful. In palpitation and also in amenorrhœa it has been found serviceable:—

℞ Fluidext. senegæ,
Spt. chloroformi ..... aa 4| c.cm. or f3j.
Syr. pruni Virg. ..... q. s. ad 60| c.cm. or f℥ij.
M. Sig.: Take a dessertspoonful every two or three hours, for cough.

Senega is not to be used in heart disease on account of the depressing effects of its active principle. (See **Saponin.**) Senega has been administered, in doses of 0.13 Gm. (or gr. ij) in uterine hæmorrhage. A decoction of senega-root, a pint being taken daily for a fortnight before the expected period, has been successfully employed in amenorrhœa. In chronic rheumatism, its diaphoretic and diuretic effects are useful.

SENNA (U. S. P.).—**Senna.**

SENNA ALEXANDRINA (B. P.).—**Alexandrian Senna.**

SENNA INDICA (B. P.).—**East Indian Senna (Tinnivelly Senna).**

Dose, 4 to 10 Gm. (or 3i-iiss).

Preparations.

Fluidextractum Sennæ (U. S. P.).—Fluid Extract of Senna. Dose, 2 to 15 c.cm. (or *m*xxx-f3iv).

Infusum Sennæ Compositum (U. S. P.).—Black Draught (senna, manna, Epsom salt, fennel, water). Dose, 60 to 120 c.cm. (or f℥ii-iv) every four hours until it operates.

Infusum Sennæ (B. P.).—Infusion of senna (senna, 10 per cent., with ginger and distilled water). Dose, 15 to 30 c.cm. (or f℥ss-j).

Syrupus Sennæ (U. S. P., B. P.).—Syrup of Senna (U. S. P. contains senna, oil of coriander, alcohol, sugar, and water). Dose, 4 to 15 c.cm. (or f3i-iv). B. P., 2 to 7.5 c.cm. (or f3ss-ij).

Confectio Senna (U. S. P., B. P.).—Confection of Senna (U. S. P. contains cassia fistula, senna, oil of coriander, tamarind, prune, fig, sugar, water). Dose, 4 to 8 Gm. (or 3i-ij).

Pulvis Glycyrrhizæ Compositus (U. S. P., B. P.).—Compound Powder of Glycyrrhiza (U. S. P. contains senna, licorice-root, oil of fennel, washed sulphur, sugar). Dose, 4 to 8 Gm. (or 3i-ij).

Mistura Sennæ Composita (B. P.).—Compound Mixture of Senna, Black Draught (magnesium sulphate, 250 Gm.; liquid extract of licorice, 50 c.cm.; compound tincture of cardamoms, 100 c.cm.; aromatic spirit of ammonia, 50 c.cm.; infusion of senna, a sufficient quantity to produce 1000 c.cm.). Dose, 30 to 60 c.cm. (or f℥i-ij).

Tinctura Sennæ Composita (B. P.).—Compound Tincture of Senna (senna, 200; with raisins, caraway-, and coriander- fruit; alcohol, 45 per cent., q. s.). Dose, 2 to 4 c.cm. (or f℥ss-j).

Liquor Sennæ Concentratus (B. P.).—Concentrated Solution of Senna (senna, 1000 Gm., tincture of ginger, alcohol, and distilled water, q. s. ad 1000 c.cm.). Dose, 2 to 4 c.cm. (or f℥ss-j).

Fluid extract of senna enters into the compound syrup of sarsaparilla (U. S. P., 15 parts to 1000).

Pharmacology.—Senna is the U. S. Pharmacopœial title for "the dried leaflets of Cassia acutifolia (Alexandria senna), and of Cassia angustifolia (India senna)," plants of the natural order Leguminosæ, which must be freed from stalks, discolored leaves, and other admixtures. Senna Alexandrina and Senna Indica are named as official in the British Pharmacopœia. The cathartic effect of rhubarb, senna, aloes, and frangula is due to the presence of the irritant anthracene ($C_{14}H_{10}$), or anthraquinone, in combinations only a few of which have been isolated. The principal constituent of senna is **Cathartin**, or **Cathartinic acid**, an acid glucoside. **Emodin** or trioxymethyl-anthraquinone is present in all the members of the above group. Rhubarb and senna also contain chrysophanic acid (dioxymethyl-anthraquinone). Pure cathartinic acid is very liable to undergo decomposition.

Physiological Action.—Senna has a faint, disagreeable smell and a bitter, nauseous taste. Senna is an active, but not an acrid, cathartic. It generally acts in about four hours, producing copious, yellow stools; any tendency to griping may be avoided by using the deodorized fluid extract, or by combining aromatics with the other preparations. It is an hepatic stimulant of feeble power, rendering the bile more watery. Its use as a cathartic does not produce constipation. The menstrual flow may be excited by it, and if given to a nursing woman her milk may acquire purgative properties. Injected into the veins, **Cathartin** produces both vomiting and purging, and in overdoses it acts as a drastic cathartic, but is never poisonous in its effects. It is too irritant to the bowel to use in full doses where hæmorrhoids are present. When taking senna the urine becomes a purple-red color on addition of alkalies. The chrysophanic acid also gives a yellowish tinge to the urine.

Therapy.—This drug is a safe, efficient, and, when combined with other drugs, a pleasant cathartic for constipation, or where simple unloading of the bowels is required. It should not be given where there is danger of abortion, or where inflammatory conditions of the intestine exist. It is a favorite laxative for pregnant women in the form of confection of senna and compound licorice-powder, and the syrup is a good laxative for children. The infusion is useful to carry off worms from the intestines. Senna and manna (or black draught, U. S. P.) is an efficient, but uninviting, cathartic, and has nearly gone out of use, because its place has been taken by more pleasant remedies. Bartholow states that the addition of coffee masks the unpleasant taste of senna. The following formula for a cheap and efficient laxative is given by Mr. G. H. Dunn: 15.5 Gm. (or ℥ss) of senna-leaves are placed in a quart of water and boiled fifteen minutes in a covered dish. The liquid is then strained and 8 Gm. (or ℥ij) of dry sugar added; 248 Gm. (or ℥viij) each of figs and prunes are cut up, added to the liquid, and the whole is boiled until the fruits get thoroughly soft. Dose, 1 teaspoonful after each meal. A better method of making this would be to stew the fruit separately, and, after it has cooled, to add 15 c.cm. (or f℥ss) of the deodorized

fluid extract, since the active principle, cathartic acid, is destroyed by heat. Laxative prunes may be made by adding syrup of senna or the fluid extract to the stewed fruit. A confection of senna made into a flattened bolus (4 to 8 Gm., or 5i-ij), and coated with sugar or chocolate, forms a proprietary pharmaceutical known as fruit laxative, or "Tamar Indien," as it is said to contain tamarind. They are readily eaten by children. Dr. Angel Bilbao has found that the administration of purgative doses of senna for a number of consecutive days diminished or arrested incontinence of urine present in the early stages of locomotor ataxia. The simple infusion of a few leaves, or seeds, in hot water, is popularly used in Russia, as a laxative.

Cathartic acid has lately been employed as a purgative, and Dr. Kohlstock reports from the clinic of Professor Senator, of Berlin, favorable results from its action. It may be given by the mouth in the form of a powder rubbed up with sugar in the dose of 0.05 Gm. (or gr. $^{5}/_{6}$), to children from 2 to 4 years, and 0.15 Gm. (or gr. ii $^{1}/_{4}$) to adults. Kohlstock administered it by the rectum, injecting 1 c.cm. (or *m*xv) of the following solution:—

℞ Acid. cathartic.	3|	Gm. or gr. xlv.
Aq. destillat.	7|	c.cm. or f3i $^{6}/_{4}$.
Sodii bicarbonat.	q. s. ad react. alkaline.—M.	

Commercial cathartic acid, according to the *Druggists' Circular* (January, 1904), is in reality a mixture of the calcium, magnesium, and potassium salts of cathartinic acid as they exist in senna-leaves. It occurs as brownish-black granules or scales, soluble in water. It is used instead of senna chiefly in children. Dose for a child, 0.10 to 0.20 Gm. (or gr. ii-iij); adults take 2 to 3 times as much.

SERPENTARIA (U. S. P.).—**Serpentaria (Virginia Snake-root).**

SERPENTARIÆ RHIZOMA (B. P.).—**Serpentary Rhizome.**

Dose, 0.65 to 4 Gm. (or gr. x-3j). B. P., 2 to 4 c.cm. (or f3ss-j).

Preparations.

Fluidextractum Serpentariæ (U. S. P.).—Fluid Extract of Serpentaria. Dose, 0.60 to 2 c.cm. (or *m*x-xxx).

Tinctura Serpentariæ (U. S. P., B. P.).—Tincture of Serpentaria (10 per cent.; B. P., 20 per cent.). Dose, 4 to 7.5 c.cm. (or f3i-ij).

Liquor Serpentariæ Concentratus (B. P.).—Concentrated Solution of Serpentary (serpentary, 500 Gm.; alcohol [20 per cent.], 1000 c.cm.). Dose, 2 to 7.5 c.cm. (or f3ss-ij).

Infusum Serpentariæ (B. P.).—Infusion of Serpentary (5 per cent.). Dose, 15 to 30 c.cm. (or f3ss-j).

The compound tincture of cinchona (U. S. P.) contains 2 per cent. (B. P. 2 $^{1}/_{2}$ per cent.) of serpentaria.

Pharmacology.—"The dried rhizome and roots of Aristolochia Serpentaria or of Aristolochia reticulata" (Aristolochiaceæ): plants growing in the southern and western portions of the United States. The British Pharmacopœia recognizes only Aristolochia Serpentaria as the source. The name snake-root, of itself, is not distinctive, and should not be used, because by this title several different plants are commonly called; for instance, Canada snake-root is Asarum Canadense, or wild ginger; black snake-root is Actæa racemosa, or cimicifuga; evergreen snake-root is Polygala paucifolia, or fringed polygala; while rattlesnake-root, or senega snake-root, is Polygala

Senega. Texas snake-root is Aristolochia reticulata, and Virginia snake-root is Aristolochia Serpentaria. Serpentaria contains a bitter principle, **Aristolochin**, or **Serpentarin** (thought to be identical with clematitin), soluble in water and alcohol; also a **volatile oil** (containing **Borneol**), and some **resin**. The active principle is not used in medicine. All the preparations should be made from the fresh root, as it deteriorates by keeping. A small proportion of an alkaloid, **Aristolochine**, has been found in the Argentina variety, combined with **aristinic**, **aristidinic**, and **aristolic** acids.

Physiological Action.—Serpentaria is a tonic, a cardiac stimulant, and has some antiperiodic powers. It has a pungent, characteristic flavor, and small doses promote appetite and digestion, and are slightly exhilarating. Large doses cause considerable intestinal disturbance, flatulence, tenesmus, and frequent evacuations of semisolid stools; they are also productive of nausea and vomiting, with much headache and dizziness. Hæmorrhoids are irritated and menstruation is stimulated. The drug is expectorant. Although asserted to possess aphrodisiac powers, it is doubtful if serpentaria has any direct influence of this kind, probably acting simply as a stimulant to the circulation and as a general tonic.

Therapy. — Though physiologically active, serpentaria is rarely used alone. In atonic dyspepsia, it is a useful adjunct to cinchona in the compound tincture. It is also a good general tonic. Tablespoonful doses of a decoction of serpentaria are often able to allay bilious vomiting. The infusion is a useful wash for spongy gums, diphtheritic inflammation, or the sore throat of scarlatina. In pneumonia of a low type, serpentaria is useful in combination with the aromatic spirit of ammonia; and in bronchial catarrh it is a good expectorant. Its combination of expectorant and stimulant properties renders serpentaria useful, also, in capillary bronchitis. It has some reputation as a restorative in typhoid and typhus fevers, and in depressed conditions of the system generally. In chronic rheumatism it may be given in combination, with excellent results. In amenorrhœa dependent upon anæmia or chlorosis, serpentaria is said to have given good results. Serpentaria has also been given with success in functional impotence.

SERUM ANTIDIPHTHERITICUM (U. S. P.).—**Antidiphtheritic Serum.** (See **Animal Extracts.**)

SEVUM PRÆPARATUM (U. S. P., B. P.).—**Prepared Suet.**

Pharmacology and Therapy. — "The internal fat of the abdomen of the sheep, ovis aries (class, Mammalia; order, Ruminantia), purified by melting and straining." If in well-closed vessels, it will keep for an indefinite time in a cool place, without turning rancid, which would spoil it for pharmaceutical purposes. It is a solid fat, with slight taste and very little odor, consisting chiefly of stearin. It should not be used after it has become rancid. It is used to give greater consistency to ointments, and enters into the official ointment of mercury. For warm weather, a good ointment can be made as follows:—

℞ Hydrarg. chloridi mitis	2	60 Gm. or gr. xl.
Sodii benzoatis		65 Gm. or gr. x.
Sevi preparati	31	Gm. or ℥j.
Olei amygdalæ amaræ		12 c.cm. or *m*ij.

M. Sig.: For eczema or intertrigo. Apply upon soft linen.

SILICON.—Silica.

Preparation.

Liquor Sodii Silicatis (U. S. P.).—Solution of Sodium Silicate, or Soluble Glass. For external use.

Pharmacology and Therapy.—Silicon is a non-metallic, elementary body, discovered by Berzelius in 1825. Its atomic weight is 28. It is obtained in two forms: amorphous and crystalline. In nature, its compounds, with fluorine (silicon fluoride) and oxygen (silicic oxide), are widely diffused, and are known as fluor-spar and rock-crystal, or quartz, and, in a granular form, as sandstone or sand. Crystallized quartz, or rock-crystal, is used for the manufacture of spectacle glasses and lenses. Window-glass is a mixture of potassium or sodium silicate with calcium silicate, and often contains aluminum silicate also. It is made by the prolonged fusion of potassium or sodium carbonate with pure quartz, sand, and lime. Flint glass contains lead, introduced in the form of red lead. Various colored glasses are made by adding metallic oxides to the above ingredients previous to fusion. **Hydrofluosilic acid** is a saturated aqueous solution of this acid, prepared by passing silicon fluoride (which is a colorless, suffocating gas, producing white fumes when allowed to escape into the air) through water. It is employed as a reagent in the laboratory. The solution of sodium silicate contains about 10 to 12 per cent. of soda, and 20 to 24 per cent. of silica. It is a clear, almost colorless, viscid, odorless fluid, with alkaline taste and reaction, and should not produce any irritant effects upon the skin. It dries in a short time, yielding a smooth, glassy surface. In making dressings for fractures, successive layers of bandage are applied smoothly to the limb, rubbing the solution into each layer of bandage, until a sufficient thickness is obtained. The dressing is then allowed to dry, and a finishing coat is given with the brush, making a good permanent dressing. If desired, when applied to a limb, the apparatus may be slit up the back and front, and trimmed with scissors, so as to make two lateral molded splints. Sodium silicate has also been used to take the place of the gypsum of the plaster jacket in the treatment of Pott's disease. The silicate apparatus is neat, light, and can be perforated for ventilation.

A solution of **Potassium Silicate** is used in the same manner as the preceding, and, by some, a mixture of these two is considered preferable to either alone. It also has antiseptic qualities, and has been used as an injection, properly diluted, in gonorrhœa, vaginitis, and cystitis; or applied as a dressing to erysipelas, with asserted good results.

The compound known as the sodium silico-fluoride has had a limited use as an antiseptic. Laplace reports that in the laboratory, as well as in the clinic-room, negative results have followed its employment as an antiseptic. Flagg, on the other hand, in dental practice, says that sodium silicofluoride is both a disinfectant and antiseptic. It is used in the form of a salt or solution (5 to 8 per cent.) in water. It is, he adds, noteworthy as possessing the unusual and most desirable characteristics of being non-irritant, non-poisoning, neither discoloring nor staining, of decided rank as a disinfectant and deodorizer, odorless, and of positively indefinite maintenance of integrity,—the solutions of three years' duration giving ocular evidence of being unchanged. The hydrated magnesium silicate has been utilized in France as a protective and absorbent in diarrhœa, in the same way that bis-

muth is ordinarily used, in doses of 4 to 7.5 c.cm. (or f3i-ij). Friction with sand has been employed by Ellinger for detaching the scales in psoriasis.

SIMULO.—An herb of the Caper family, Capparis corriaceæ (Capparidaceæ), known as the simulo-plant, has had attention directed toward it by the investigations of Eulenberg[1] and others. No analysis has yet been made, and it is not known definitely whether or not it has any principle with positive therapeutic action. The kernel of the fruit, which is almond-shaped, is the portion used. An alcoholic tincture of the drug has been employed, but it is less valuable than a fluid extract, since the alcohol may counteract the sedative influence of the remedy.

Physiological Action.—The physiological effects have not been investigated. Under its therapeutic use, Dr. Starr observed no change in pulse, respiration, or temperature; no effect upon the pupils, no muscular weakness, no mental depression or stimulation, and no digestive disturbance. It appears to be quite innocuous, even in very large doses, according to Dr. V. Paulet.

Therapy.—Simulo is one of the many agents which have been brought forward to cure cases of epilepsy, and in other nervous affections favorable results from its use have also been reported. Dr. V. Paulet found it to have decidedly good effects in hysteria and chorea.[2] Dr. W. H. White used the tincture of simulo in seven cases of epilepsy, giving 4 to 7.50 c.cm. (or f3i-ij) three times a day. In all the patients considerable improvement took place, though complete cure was attained in none. Dr. M. Allen Star finds that it has some effect in modifying the frequency and severity of attacks of *grand mal*, but is in this respect inferior to the bromides. It is useless in *petit mal* and in hystero-epilepsy. About the only field of usefulness for simulo would appear to be when, for any reason, it is deemed necessary to temporarily suspend the use of the bromides. Dr. L. C. Gray, in several cases, found the drug useless.[3]

The tincture in doses of 0.30 to 0.60 c.cm. (or *m*v-x) thrice daily, beginning five days before the expected period, is said to relieve dysmenorrhœa. Dr. Paulet recommends the drug as of service in ovaro-salpingitis.

SINAPIS (B. P.).—**Mustard.**

SINAPIS ALBA (U. S. P.), **SINAPIS ALBÆ SEMINA** (B. P.).—**White Mustard, White Mustard-seed.**

SINAPIS NIGRA (U. S. P.), **SINAPIS NIGRÆ SEMINA** (B. P.).—**Black Mustard, Black Mustard-seed.**

Preparations.

Oleum Sinapis Volatile (U. S. P., B. P.).—Volatile Oil of Mustard.

Chartæ Sinapis (U. S. P., B. P.).—Mustard Paper.

Linimentum Sinapis (B. P.).—Liniment of Mustard (contains volatile oil of mustard, 2 c.cm.; camphor, 3 Gm.; castor-oil, 7 c.cm.; alcohol, 90 per cent., 43 c.cm.).

Linimentum Sinapis Compositum.—Compound Liniment of Mustard (volatile oil of mustard, 3; fluid extract of mezereum, 20; camphor, 6; castor-oil, 15; alcohol, q. s. ad 100 parts). For external use.

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[1] *Therapeutic Gazette*, Oct. 15, 1888.

[2] *American Journal of Insanity*, July, 1890.

[3] *Therapeutic Gazette*, June 15, 1889.

Pharmacology.—White and black mustard are the seed of Brassica alba and the seed of Brassica nigra (Cruciferæ), respectively (U. S. P.). They form the flour of mustard when ground to a fine powder; commercial flour of mustard is a mixture of both kinds of seeds ground together. It is this mixture which constitutes the mustard of the British Pharmacopœia. The pungency of the moist powder is due to the volatile oil of mustard, which does not exist in the whole seeds. The black and white varieties each contain a crystalline substance,—in the former **Sinigrin**, in the latter **Sinalbin**,—together with an albuminous ferment, **Myrosin**. When water is added, both sinigrin and sinalbin are split up by the myrosin and produce a volatile oil which is not quite identical in the two mustards, that from the black mustard being the more pungent. The action of myrosin is suspended at 60° C. (140° F.); so that mustard poultice should not be made with boiling water. White mustard, even when ground and mixed with water, is inodorous, but when added to the black variety it increases the yield of volatile oil. Both kinds also contain fixed oil, para-hydroxy-benzyl-isothiocyanate, or "acrinyl sulphocyanide," as well as **Sinapine** (an alkaloid), **brassic acid**, and other vegetable principles.

Physiological Action.—When applied to the skin, if moisture is present, mustard-flour causes hyperæmia, and, if the action is continued, it will vesicate, making a painful and slow-healing blister. The volatile oil of mustard causes rubefaction and generally is used in combination, as in the compound liniment, as a counter-irritant. When used alone, it should be diluted with alcohol (1 to 60) or some other vehicle. It is a good substitute for the mustard plaster, when applied upon flannel.

Therapy.—Mustard-papers (4 inches square) are very convenient for applying counter-irritation (being always ready for use and only needing dampening with cold water) in pleurodynia, lumbago, colic, croup, and numerous other conditions requiring this treatment; can also be applied to the calves of the legs, as well as other parts of the body where counter-irritation is necessary. They should remain ordinarily about four or five minutes, but may remain longer; they should not be left on all night, for fear of making a slough which would leave a scar. Mustard poultices to the feet and legs are employed as derivatives in apoplexy and intoxication from alcohol or opium. In weak digestion, a little mustard, as a condiment with meats, assists digestion and stimulates the secretion of gastric and intestinal fluids.

Mustard foot-baths, made by adding a handful of ground mustard to warm water, is a good revulsant in recent colds, sleeplessness, amenorrhœa, headache, etc. Mustard-water is a useful emetic in narcotic poisoning. A hot mustard-bath is an efficient aid to other treatment in allaying maniacal excitement. It is of value, moreover, in cases of recession of the eruption in scarlet fever and measles.

In medicinal preparations, mustard is occasionally administered with advantage as an internal remedy. Obstinate hiccough has been relieved by an infusion made by steeping a teaspoonful, about 4 Gm. (or ʒj), of mustard in 120 c.cm. (or f℥iv) of boiling water for twenty minutes and then straining (Ringer). An alcoholic solution of the oil of mustard has been found of efficiency in chronic gastric and bronchial catarrh. This preparation is said to have been of service as a diuretic in dropsy. A mustard-whey, made by

boiling 15.5 Gm. (or ℥ss) of mustard-flour in a pint of milk, has also been utilized in dropsy.

SISYRINCHIUM.—The root and herb of Sisyrinchium angustifolium, or anceps (Amaryllidaceæ), or blue-eyed grass, are used by North American Indians as an antidote to rattlesnake poison. The tincture or decoction of the fresh root is given internally, and locally the powdered root is applied, as stated by C. L. Thudichum.[1] There is also a variety with yellow flowers found in Missouri.

SODIUM (B. P.).—The metallic element, **Sodium (Natrium).** Not used in medicine, except in combination.

Salts and Preparations.

Sodii Hydroxidum (U. S. P.).—Sodium Hydroxide, Caustic Soda.

Liquor Sodii Hydroxidi (U. S. P.).—Solution of Sodium Hydroxide (5 per cent. of the hydrate). Dose, 0.30 to 0.60 c.cm. (or *m*v-x).

Liquor Sodæ Chlorinatæ (U. S. P., B. P.).—Solution of Chlorinated Soda (Labarraque's solution). Should contain at least 2.6 per cent., by weight, of available chlorine. Dose, 2 to 4 c.cm. (or f℥ss-j).

Potassii et Sodii Tartras (U. S. P.).—Potassium and Sodium Tartrate (Rochelle salt). Dose, 4 to 15.5 Gm. (or ℥i-iv).

Mistura Rhei et Sodæ (U. S. P.).—Mixture of Rhubarb and Soda. Dose, 7.5 to 15 c.cm. (or f℥ii-f℥ss).

Pulvis Effervescens Compositus (U. S. P.).—Compound Effervescing Powder, Seidlitz Powder. Dose, one powder.

Trochisci Sodii Bicarbonatis (U. S. P.).—Troches of Sodium Bicarbonate (each, 0.20 Gm., or gr. iij). Dose, 1 or more troches.

Sodii Acetas (U. S. P.).—Sodium Acetate. Dose, 1 to 4 Gm. (or gr. xv-℥j).

Sodii Bisulphis (U. S. P.).—Sodium Bisulphite. Dose, 0.65 to 2 Gm. (or gr. x-℥ss).

Sodii Boras (U. S. P.).—Sodium Borate, Borax (B. P.). Dose, 0.65 to 2.60 Gm. (or gr. x-xl).

Sodii Chloras (U. S. P.).—Sodium Chlorate. Dose, 0.13 to 0.65 Gm. (or gr. ii-x).

Sodii Nitras (U. S. P.).—Sodium Nitrate (saltpetre). Dose, 0.32 to 2.60 Gm. (or gr. v-xl).

Sodii Pyrophosphas (U. S. P.).—Sodium Pyrophosphate. Dose, 0.32 to 2.60 Gm. (or gr. v-xl).

Sodii Arsenas (U. S. P., B. P.).—Sodium Arsenate. Dose, 0.005 to 0.02 Gm. (or gr. $^1/_{12}$-$^1/_3$). B. P., 0.0016 to 0.006 Gm. (or gr. $^1/_{40}$-$^1/_{10}$).

Sodii Arsenas Exsiccatus (U. S. P.).—Dried Sodium Arseniate. (This is also officinal in B. P., but under the title "Sodii Arsenas.") Dose 0.003 Gm. (or gr. $^1/_{20}$).

Sodii Benzoas (U. S. P., B. P.).—Sodium Benzoate. Dose, 0.65 to 1.30 Gm. (or gr. x-xx).

Sodii Bicarbonas (U. S. P., B. P.).—Sodium Bicarbonate (baking-soda). Dose, 0.32 to 2.60 Gm. (or gr. v-xl).

Sodii Bromidum (U. S. P., B. P.).—Sodium Bromide. Dose, 1.30 to 4 Gm. (or gr. xx-℥j).

Sodii Carbonas Monohydratus (U. S. P.), Sodii Carbonas (B. P.).—Sodium Carbonate (washing-soda). Dose, 0.12 to 1 Gm. (or gr. ii-xv).

Sodii Carbonas Exsiccatus (B. P.).—Dried Sodium Carbonate. Dose, 0.32 to 0.65 Gm. (or gr. v-x).

Sodii Chloridum (U. S. P., B. P.).—Sodium Chloride (table-salt). Dose, 0.32 to 2.60 Gm. (or gr. v-xl).

Sodii Citras (U. S. P.).—Citrate of Sodium. Dose, 24 to 40 Gm. (or ℥vi-x.).

Sodii Hypophosphis (U. S. P., B. P.).—Sodium Hypophosphite. Dose, 0.32 to 1 Gm. (or gr. v-xv). Enters into the official compound syrup of hypophosphites.

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[1] *Surgical Clinic*, April, 1903.

Sodii Iodidum (U. S. P., B. P.).—Sodium Iodide. Dose, 0.32 to 2 Gm. (or gr. v-xxx).

Sodii Nitris (U. S. P., B. P.).—Sodium Nitrite. Dose, 0.065 to 0.20 Gm. (or gr. i-iij).

Sodii Phosphas (U. S. P., B. P.).—Sodium Phosphate. Dose, 0.32 to 31 Gm. (or gr. v-℥j).

Sodii Phosphas Effervescens (U. S. P., B. P.).—Effervescent Phosphate of Sodium.

Sodii Phosphas Exsiccatus (U. S. P.).—Dried Phosphate of Sodium.

Liquor Sodii Phosphatis Compositus (U. S. P.).—Compound Solution of Sodium Phosphate. (Each c.cm. contains 1 Gm. [or *m*xv] of the sodium phosphate.) Dose, 4 to 8 c.cm. (or f3j-ij).

Sodii Salicylas (U. S. P., B. P.).—Sodium Salicylate. Dose, 0.65 to 2 Gm. (or gr. x-3ss).

Sodii Sulphas (U. S. P., B. P.).—Sodium Sulphate (Glauber's salt). Dose, 15.5 to 31 Gm. (or ℥ss-j).

Sodii Sulphis (U. S. P., B. P.).—Sodium Sulphite. Dose, 1.30 to 2 Gm. (or gr. xx-3ss).

Sodii Thiosulphas (U. S. P.).—Sodium Thiosulphate. Dose, 0.65 to 1.30 Gm. (or gr. x-xx).

Sodii Phenolsulphonas (U. S. P.), Sodii Sulphocarbolas (B. P.)—Sodium Sulphocarbolate. Dose, 0.13 to 1 Gm. (or gr. ii-xv).

Liquor Sodii Arsenatis (U. S. P., B. P.).—Solution of Sodium Arsenate (1 per cent.). Dose, 0.18 to 0.30 c.cm. (or *m*iii-v).

Sodii Citrotartras Effervescens (B. P.).—Effervescent Sodium Citrotartrate (mixture of sodium bicarbonate, tartaric and citric acids, and refined sugar). A granulated, effervescent salt. Dose, 4 to 8 Gm. (or gr. lx-cxx).

Sodii Phosphas Effervescens (B. P.).—Effervescent Sodium Phosphate (mixture of sodium phosphate and bicarbonate, tartaric and citric acids). Dose, 4 to 8 Gm. (or 3i-ij) for repeated administration; for a single administration, 8 to 15.5 Gm. (or 3ii-iv).

Sodii Sulphas Effervescens (B. P.).—Effervescent Sodium Sulphate (mixture of sodium sulphate and bicarbonate, tartaric and citric acids). Dose, 4 to 8 Gm. (or 3i-ij) for repeated administration; for single administration, 8 to 15.5 Gm. (or 3ii-iv).

Liquor Sodii Ethylatis (B. P.).—Solution of Sodium Ethylate (contains 18 per cent. of the solid substance, C_2H_5ONa).

Pulvis Sodæ Tartaratæ Effervescens (B. P.).—Effervescent Tartarated Soda Powder, Seidlitz Powder.

Soda Tartarata (B. P.).—Sodium Potassium Tartrate (Rochelle salt). Dose, 4 to 15.5 Gm. (or 3i-iv).

Sodii Santoninas.—Sodium Santoninate. Dose, 0.13 to 0.65 Gm. (or gr. ii-x).

Trochisci Sodii Santoninatis.—Troches of Sodium Santoninate. Each, 0.13 Gm. (or gr. ij). Dose, 1 to 5 troches.

Liquor Sodii Ethylatis (B. P.).—Solution of Sodium Ethylate. For external use as a caustic (consists of sodium ethylate, 1.5 Gm., or gr. xxij, dissolved in absolute alcohol, 30 c.cm., or f℥j).

Pasta Londoniensis.—London Paste is prepared by rubbing together equal parts of caustic soda and unslaked lime. For external use.

Pharmacology. — The metal sodium, a monatomic, metallic element, Natrium (Na. = 23), was discovered by Sir Humphry Davy in 1807, the same year that he succeeded in isolating the metal potassium, which, in many respects, it resembles. It is found only in the laboratory and in the arts, not being used in its own form in medicine. Many of its salts are official; they are generally white or colorless, soluble in water, and less irritant than the corresponding potassium salts. They tinge the flame yellow, in the spectroscope, or when a small portion, on a piece of plantinum wire, is held over burning alcohol. Sodium chloride occurs native in seawater and in salt-mines, and is found in all the fluids and solids of the

human body. Sodium urate is not soluble in water, and, therefore, when uric acid is formed in excess, deposits of sodium urate are apt to occur in various portions of the body. The potassium and lithium salts, with the uric acid, on the contrary, are soluble in water, and assist in carrying off from the system the less soluble uric acid. In gouty patients, therefore, soda-salts should be only cautiously given.

Physiological Action.—Soda, when locally applied, in concentrated form, to muscle or nerve, is a paralyzing agent, but to a decidedly smaller extent than potassa. Caustic soda in its action resembles caustic potash, but has less tendency to spread. Solutions of the chloride are antiseptic, and table-salt, as an article of food, plays a very important part in digestion and in tissue-change. Weak solutions of salt (5 to 6.5 parts per 1000), if injected into the veins, do not affect the integrity of the red blood-corpuscles. The carbonate may be used in the same manner, to replace a quantity of blood lost by hæmorrhage, or in the collapse of cholera. Applied to the skin, solutions of the bicarbonate are cleansing and non-irritant; and, in cases of burns or scalds, insect-bites, or ivy poisoning, a saturated solution rapidly relieves pain. Borax is also antiseptic and unirritating to the skin. The hyposulphite is antiseptic by virtue of the sulphuric acid which it contains. The ethylate is also an antiseptic, and decidedly caustic. Liquor sodæ is a valuable antacid, without affecting nutrition as much as potassa does, and it is less poisonous to the heart and nerves. The acetate, being the salt of an organic acid, becomes converted into the carbonate in the blood; it is diuretic, although to a less extent than the potassium acetate. Sodium carbonate is used in pharmacy in preparing other salts; as it is a good alkali for combining with grease or fat, it is found in every household as "washing-soda." The bicarbonate is used as an antacid when there is an excess of acid in the stomach; given when the stomach is empty, it stimulates the secretion of gastric juice.

Linossier and Lemoine conclude that sodium bicarbonate, in all amounts, excites gastric secretion, the most useful dose, according to their observation, being 5 Gm. (or gr. lxxv), given before a meal. An increased secretion is maintained beyond the day of administration.

It also increases the alkalinity of the blood, reduces the acidity of the urine, and relieves irritability of the bladder. Sodium chloride is a very convenient emetic, especially when combined with mustard-water. Hæmorrhages are sometimes checked by it through reflex influence. The nitrate is refrigerant in fever, and increases the secretions of the intestinal tract. The nitrite acts like the other nitrites, in depressing the heart's action and reducing blood-pressure. The sulphate is a bad-tasting and harsh cathartic; it is a common constituent in purgative mineral waters, where its effects are enhanced and modified by natural combination.

As borax is largely used as a preservative for meat, the following observations are of special interest:—

Chittenden and Giess found that moderate doses of borax up to 5 Gm. (or gr. lxxv) per day, even when continued for some time, are without influence upon proteid metabolism. Borax does not tend to increase bodily weight or to protect the proteid matter of the tissues.

Large doses of borax, 5 to 10 Gm. (or gr. lxxv-cl) daily, have a direct stimulating effect upon proteid metabolism, as claimed by Gruber; such

doses, especially if continued, lead to an increased excretion of nitrogen through the urine, also of sulphuric acid and phosphoric acid.

Boric acid, on the other hand, in doses up to 3 Gm. (or gr. xlv) per day, is practically without influence upon proteid metabolism and upon the general nutrition of the body.

Borax, when taken in large doses, tends to retard somewhat the assimilation of proteid and fatty foods, increasing noticeably the weight of the fæces and their content of nitrogen and fat. With very large doses there is a tendency toward diarrhœa and an increased secretion of mucus. Boric acid, on the contrary, in doses up to 3 Gm. (or gr. xlv) per day, is wholly without influence in these directions.

Borax causes a decrease in the volume of urine, changes the reaction of the fluid to alkaline, and raises the specific gravity, owing to the rapid elimination of the borax through this channel. Under no circumstances have the authors observed any diuretic action with either borax or boric acid. The latter agent has little effect on the volume of the urine.

Both borax and boric acid are quickly eliminated from the body through the urine, twenty-four to thirty-six hours being generally sufficient for their complete removal. Rarely are they found in the fæces.

Neither borax nor boric acid has any influence upon the putrefactive processes of the intestine as measured by the amount of combined sulphuric acid in the urine, or by Jaffe's indoxyl test. Exceedingly large doses of borax are inactive in this direction, not because the salt is without action upon micro-organisms, but because of its rapid absorption here.

Borax and boric acid, when given in quantities equal to 1.5 to 2 per cent. of the daily food, are liable to produce nausea and vomiting.

Owing to the rapid elimination of both borax and boric acid, no marked cumulative action can result from their daily ingestion in moderate quantities.

At no time in these experiments was there any indication of abnormality in the urine; albumin and sugar were never present.

In experiments undertaken to determine the influence of alkalies on the excretion of uric acid, made by Dr. Spilker, under the direction of Professor Salkowski, it was found that the addition of alkalies to the diet diminishes the excretion of uric acid, or rather, its formation in the human subject, while in the dog the reverse was the case.[1] This should teach us to accept, with some reserve, the deductions from physiological experiments in the laboratory, with regard to the action of medicine upon the lower animals, especially where they conflict with clinical teaching and the results of experience.

Therapy.—Sodium hydroxide (a corrosive poison in concentrated form, the symptoms and treatment being the same as for poisoning by the corresponding potassium salt) may be used locally as a substitute for caustic potash, being more manageable and less severe. A combination of equal parts of soda and lime, known as London paste, is a favorite caustic application, especially for the removal of morbid growths, by some practitioners. Sodium ethylate is one of the most powerful caustic preparations that can be used. It combines with water of the tissues, and continues to act deeply in abstracting this element. It is serviceable in destroying warts and various mor-

[1] *Therapeutic Gazette*, Oct. 15, 1890, p. 706.

bid growths, but is liable to leave the skin scarred on account of its destructive action upon the tissues. The writer has employed sodium ethylate with great benefit in lupus erythematosus and vulgaris; likewise in callous ulcers, epithelioma, and in thickened and ulcerated spots of syphilis. If sodium ethylate is used for the removal of excessive growth of hair, especially upon the face (polytrichia), as has been recommended by Jameson, the physician may expect, from the observations made by the author, more or less scarring of the skin on account of the destructive action of this caustic upon the true skin and deeper structures. Gamberini has derived good results in psoriasis from inunction with a 2-per-cent. mixture of sodium ethylate with olive-oil.

Sodium bicarbonate, in solution made with hot water, if applied to burned or scalded surfaces, quickly relieves pain. It can also be used to subdue inflammation in sunburn, rhus poisoning, pruritus, eczema, insect-bites, etc. A 1-per-cent. solution of sodium bicarbonate is a good injection in gonorrhœa. In a number of cases intussusception of the bowel has been reduced by the action of carbonic-acid gas, which, in an emergency, may be generated within the intestine by the action of citric acid upon sodium bicarbonate. The solutions are separately injected through a tube passed into the rectum. According to Dr. Duckworth, the local use of a solution of sodium bicarbonate in the strength of 2 Gm. (or ʒss) to 30 c.cm. (or fʒj) of warm water will often relieve toothache dependent upon dental caries. In the cough of pulmonary tuberculosis, when the bronchial secretion is scanty and viscid, good results may be obtained by the use of the following solution as a spray:—

℞ Sodii bicarbonat.	1	to	2	Gm. or gr. xv-xxx.
Glycerini			4	c.cm. or f3j.
Aq. dest.			105	c.cm. or fʒiiiss.—M.

Dundas Grant recommends the following for the softening of cerumen and dislodgment of impacted masses in the auditory canal:—

℞ Sodii bicarbonatis	1	Gm. or gr. xv.
Glycerini	11	c.cm. or f3iij.
Aquæ destill. q. s. ad	30	c.cm. or fʒj.

M. To be dropped into the ear warm, and followed in a few hours by persistent syringing.

Borax acts very similarly, but is more antiseptic on account of containing boric acid. Both the bicarbonate and the borate are also employed in solutions for washing out the bladder in cystitis, for injecting into the auditory canal to remove cerumen from the ear; and for intravenous injection in collapse from cholera, etc. The following combinations containing one of the sodium preparations will be found serviceable:—

℞ Sodii bicarbonatis	15	5 Gm. or ʒss.
Aquæ camphoræ,		
Aquæ menth. pip. aa	120	c.cm. or fʒiv.

M. Sig.: For itching and burning of the mucous membrane and skin in the various eruptions upon the integument.

℞ Liq. sodæ chlorinatæ	4	to	11	c.cm. or f3i-iij.
Tinct. kino			60	c.cm. or fʒij.
Aquæ			90	c.cm. or fʒiij.

M. A disinfectant gargle for ulceration of the throat.

℞ Sodii benzoat. ..... 1|30 Gm. or gr. xx.
Creosoti ..... |30 c.cm. or *m*v.
Glycerini,
Aquæ rosæ ..... aa 15| c.cm. or fʒss.
M. Employ with an atomizer in nasal catarrh, pharyngitis, and in laryngitis.

℞ Sodii bicarbonatis..... 12| Gm. or ʒiij.
Glycerini,
Aquæ hamamelidis dest. ..... aa 90| c.cm. or fʒiij.
M. To allay itching and burning of the skin, especially in eczema, lichen, urticaria, dermatitis, burns, and frost-bite.

The solution of chlorinated soda, or Labarraque's solution, also may be advantageously applied in dermatitis due to the poison-ivy. In acute tonsillitis, sodium bicarbonate may be rubbed upon the tonsils with the finger, with excellent results. In this affection a solution of the bicarbonate has been beneficial, applied with a brush or mop, or used as a gargle. For catarrhal conditions, chronic bronchitis, etc., a solution of this salt may be used with the steam-atomizer, with hamamelis, belladonna, or other combinations if desired. Sodium chlorate was recommended by Prof. Traill Green, of Easton, to be used in place of potassium chlorate in acute affections of the throat or fauces. A lozenge made with tragacanth is just as efficient, locally, as the official potash lozenge, and will not cause depression of the heart like potash. Dr. C. Slagle, of Minneapolis, recommends sodium sulphite as an excellent local application in diphtheria, employed as a gargle, spray, or painted upon the affected surface with a camel's-hair brush. Internally he prescribes the same salt in combination with sulphur and calomel. In children suffering with oxyuris vermicularis, or seat-worm, injections of a sodium-chloride solution will bring away the parasites and relieve the itching. Sodium thiosulphite is employed by Dr. Ohmann-Dumesnil in the treatment of scabies. After a morning bath the patient is directed to apply:—

℞ Sodii thiosulphit. .....186| Gm. or ʒvj.
Aq. destillat. .....180| c.cm. or fʒvj.—M.

The solution is allowed to dry upon the skin. Before going to bed the skin is bathed with the following lotion, which may be diluted if found too strong:—

℞ Acid. hydrochloric. dil. .....120| c.cm. or fʒiv.
Aq. destillat. .....180| c.cm. or fʒvj.—M.

The phenolsulphonate is useful as a disinfectant, being less irritant and not caustic; but for internal use the salicylate is safer. Sodium bicarbonate is used as an antacid in gastritis and sour stomach, and affords temporary relief, especially in combination with mint or rhubarb. M. Huchard recommends the exhibition of large doses (from 8 to 38.8 Gm., or ʒii-x, daily) of this salt in the hyperacidity of the stomach which sometimes accompanies diabetes, in the gastric crises of locomotor ataxia, cardiac disease with acidity of the stomach, and in hepatic maladies. He mentions a case of diabetes in which this treatment averted threatened coma.

The bicarbonate, with rhubarb, is especially useful in cases of catarrhal jaundice. Sodium bicarbonate is of benefit when the urine is acid, and in all forms of cystic irritation, and is especially useful in renal calculi, cystitis, gonorrhœa, gleet, stricture, and in enlarged prostate. The following prescriptions, containing sodium bicarbonate, are recommended:—

℞ Sodii bicarbonatis ..... 14| Gm. or 3iiiss.
Tinct. zingiberis,
Tinct. capsici ..... aa 4| c.cm. or f3j.
Tinct. nucis vomicæ ..... 12|4 c.cm. or *m*cc.
Tinct. gent. comp. .....q. s. ad 150| c.cm. or f℥v.
M. Sig.: Two teaspoonfuls in water, three times a day, in acid dyspepsia.

℞ Sodii bicarbonatis ..... 10| Gm. or 3iiss.
Glycerini,
Aquæ menth. pip. ..... aa 60| c.cm. or f℥ij.
M. Sig.: Two teaspoonfuls after meals, in acid dyspepsia.

℞ Sodii bicarbonatis ..... 4| Gm. or 3j.
Pulv. ipecacuanhæ et opii ..... 2|60 Gm. or gr. xl.
M. et ft. chartulæ no. xx.
Sig.: A powder every two or three hours, for cystitis, irritable bladder or prostate.

℞ Sodii bicarbonatis ..... 2|60 Gm. or gr. xl.
Hydrargyri chloridi mitis ..... |13 Gm. or gr. ij.
M. et ft. chartulæ no. xij.
Sig.: A powder every two or three hours, for acute gastritis.

When used as an antidote to acids in corrosive poisoning, the monocarbonate is better than the bicarbonate, on account of less carbon dioxide being formed. The thiosulphate is a useful antiseptic in sarcinous vomiting and infectious dyspepsia. The salt was highly esteemed by Dr. Cadogan-Masterman, who thought, however, that 0.32 Gm. (or gr. v) doses are more efficient than larger quantities, and prescribed it as follows:—

℞ Tr. gentian. co. ..... 7|5 c.cm. or f3ij.
Tr. capsici ..... 2| c.cm. or f3ss.
Sodii bicarbonat. ..... 8| Gm. or 3ij.
Sodii thiosulphatis ..... 2|60 Gm. or gr. xl.
Chloroformi ..... |50 c.cm. or *m*viij.
Aquæ .....q. s. ad 240| c.cm. or f℥viij.
M. et ft. sol.
Sig.: Two tablespoonfuls three times a day.

Sodium thiosulphate is said to be of value in malarial hæmaturia. Sodium phosphate, on account of its cholagogic effects, is useful in cases of inaction of the liver in children who pass clay-colored stools. Constantin Paul prefers sodium phosphate to sulphate as a laxative, and administers it in the form of a lemonade, according to the subjoined formulæ:—

℞ Sodii phosphat. ..... 24|25 Gm. or 3vi ¼.
Ess. limonis ..... 1|20 c.cm. or *m*xx.
Syr. simpl. ..... 60| c.cm. or f℥ij.
Aq. destill. .....180| c.cm. or f℥vj.—M.

℞ Sodii phosphat. ..... 24|25 Gm. or 3vi ¼.
Ess. limonis ..... 1|55 c.cm. or *m*xxv.
Acid. citrici,
Sodii bicarb. ..... aa 6| Gm. or 3iss.
Syr. simpl. ..... 60| c.cm. or f℥ij.
Aq. destill. .....240| c.cm. or f℥viij.
M. An effervescing mixture.

Sodium phosphate is useful in habitual hepatic congestion and lithæmia.

Dr. Crocq, Jr., of Brussels, has employed with advantage subcutaneous

injections of sodium phosphate in various affections of the nervous system. The formula which he makes use of is:—

℞ Sodii phosphat.	2	Gm.	or gr. xxx.
Sp. rectificat.	4	c.cm.	or f℥j.
Aq. destillat.	120	c.cm.	or f℥iv.—M.

Of this solution 1 c.cm. (or *m*xv) are injected daily and the amount is gradually increased to 3 c.cm. (or *m*xlv). In trifacial neuralgia, neurasthenia, and hysteria the effects were very satisfactory. He regards the remedy thus administered as a powerful nerve-tonic, capable of curing functional disease, though it has only a palliative effect in organic disorders of nerve centres. Remarkable improvement has, however, been produced by this method in locomotor ataxia. Dr. Forbes Winslow has reported a case of the last-named malady, in which typical symptoms were present, but which disappeared after twenty-five injections had been made. The patient seemed to be completely cured. Professor Lemoine combines sodium phosphate with potassium bromide in the treatment of epilepsy, giving 1.62 Gm. (or gr. xxv) of the former salt at each dose. In order to overcome pain due to anæmia or neurasthenia, M. Huchard uses an artificial serum, 5 to 10 c.cm. (or *m*lxxx-clx) of which is subcutaneously injected. His formula is:—

℞ Sodii phosphat.	10	Gm.	or ʒiiss.
Sodii chlorid.	6	Gm.	or ʒiss.
Sodii sulphat.	2 30	Gm.	or gr. xxxvj.
Phenolis	1 55	Gm.	or gr. xxiv.
Aq. destillat.	90	c.cm.	or f℥iij.—M.

Increasing doses of sodium phosphate, given subcutaneously, are said by M. J. Luys to have a beneficial effect in morphinomania.

Sodium acetate is not as deliquescent as potassium acetate, and has this advantage over the latter salt. It has been given with benefit as an antacid in acute rheumatism, and as a diuretic in dropsies. Sodium acetate is likewise serviceable in gout, and in the treatment of irritation of the genito-urinary apparatus. The appended prescription is suggested:—

℞ Sodii acetatis	12	Gm.	or ʒiij.
Syr. aurantii	90	c.cm.	or f℥iij.
Spiritus ætheris nitrosi	60	c.cm.	or f℥ij.

M. Sig.: Two teaspoonfuls in water, every two or three hours, for rheumatism, gout, or genital irritation.

Sodium benzoate is a safe and effective antipyretic. It has been employed for its antiseptic virtues in phthisis, diphtheria, the eruptive fevers, and in irritation of the genital organs. The following combination of sodium benzoate is recommended:—

℞ Sodii benzoatis	12	Gm.	or ʒiij.
Fluidext. tritici, Fluidext. buchu aa	75	c.cm.	or f℥iiss.

M. Sig.: A teaspoonful or two, every two or three hours, for cystitis, or for an irritable bladder and prostate.

Liègeois recommends sodium benzoate in large doses in the treatment of pharyngitis. In laryngitis and acute bronchitis, he prescribes:—

℞ Sodii benzoat.	4	Gm.	or 3j.
Tr. aconit.	1	20 c.cm.	or *m*xx.
Aq. laurocerasi	4	c.cm.	or f3j.
Syrup. Tolutan.,			
Syrup. codein.,			
Aquæ aa	60	c.cm.	or f3ij.

M. Sig.: To be taken in the twenty-four hours.

Administered persistently in Bright's disease, he has obtained good results from this salt associated with tannic acid. It is useful in lithiasis by converting insoluble urates into soluble hippurates, and thus facilitating their removal from the system. M. Hébert[1] reports a case of poisoning following administration of sodium benzoate. Large erythematous patches, with intense pruritus, in various parts of the body were observed, which disappeared on discontinuance of the drug.

The following mixture is pronounced useful in chronic bronchitis by a writer in *La Tribune Médicale*:—

℞ Sodii arsenat.		10 Gm.	or gr. iss.
Sodii iodid.	10	Gm.	or 3iiss.
Aquæ	270	c.cm.	or f3ix.

M. Sig.: A tablespoonful three times a day during twenty days of the month.

Sodium citrate has been used to counteract the acidity of cow's milk (1 to 500, or gr. j to each ounce), in feeding infants, by F. J. Poynton.[2] It is regarded as much superior to sodium bicarbonate for this purpose. It softens the curd and obviates milk dyspepsia.

The pulvis effervescens compositus (U. S. P.) and pulvis sodæ tartaratæ effervescens (B. P.), commonly known as Seidlitz powder, is a mixture taken while effervescing, containing 2.60 Gm. (or gr. xl) of sodium bicarbonate and 8 Gm. (or 3ij) of Rochelle salt (blue paper) and 2.25 Gm. (or gr. xxxv) of tartaric acid (in a white paper).[3] The contents of each paper are dissolved in half a glassful of water (the blue paper first) and drunk while effervescing, to relieve simple constipation. In obstinate vomiting small doses of Seidlitz powder are often efficient in overcoming the nausea and retching. A teaspoonful of sodium chloride, dissolved in a tumblerful of water and taken before breakfast, will often answer the same purpose as some mineral waters. In full doses sodium sulphate is an active cathartic; in smaller quantities it acts as an aperient and diuretic. This salt has a bitter and nauseous taste, which may be disguised by the addition of a few drops of aromatic sulphuric acid, or by giving it in lemonade. In daily doses of 10 Gm. (or 3iiss) sodium sulphate has been administered with decided success in dysentery. It is recommended that the sodium salt be associated with naphthol or other efficient intestinal antiseptics, a solution of the latter being given by the mouth or injected into the bowel.

Sodium sulphate has been recently employed as a local application to the inflamed area in erysipelas by Dr. G. L. Curtis.[4] The rationale of this treatment is found in the affinity which sulphate of sodium has for oxygen, abstracting it so rapidly from the diseased area as soon to destroy the germ

[1] *Normandie Médicale*, Jan. 1, 1899.

[2] *Brit. Med. Journal*, Oct. 21, 1905.

[3] These may also be put up without Rochelle salt, and were formerly official in this shape as soda-powders, or Pulveres Effervescentes.

[4] *Medical Record*, April 20, 1901.

of erysipelas. His method of application is first to thoroughly cleanse the parts affected, being particular to remove all greasy substances; a sufficient quantity of sodium sulphate is mixed with cold distilled water to make a thick poultice; the diseased part is covered with a single layer of gauze, and over this is spread a thick layer of sodium sulphate, care being taken that it extends considerably beyond the margin of the diseased area; this is then covered with a few layers of gauze, and ice-water applied. He has found that with an application of this kind the disease is brought to a stand-still in from six to eight hours. If the disease involve the face, the poultice is applied to the nose and mouth, openings in the latter being made for breathing.

Sodium chloride has been injected into the veins in severe hæmorrhage and cholera. In order to avoid the disadvantages and delays of this method, Dr. Warman made trial of salt solution by the rectum. In a number of cases of uterine hæmorrhage he found this procedure to be followed by the most gratifying results. He employed about a tablespoonful of table-salt dissolved in a quart of water. Dr. Ilberg, having observed good results from the subcutaneous injection of a solution of salt in a case of gastric ulcer, made use of the same method in a number of insane patients who refused food. The treatment was satisfactory in all but one case. Experimenting upon himself he found that the instillation excited thirst and hunger. About a pint of a $^3/_4$-per-cent. solution was slowly introduced through a trocar into the cellular tissue of the back or thigh, and its absorption aided by gentle massage. The normal salt solution contains about a teaspoonful of sodium chloride to the pint. The method just mentioned is known as hypodermoclysis, and has been employed successfully in cholera. Max Gordon reports three cases of poisoning from carbonic oxide or coal-gas successfully treated by the intravenous injection of a salt solution, after a preliminary bleeding. Subcutaneous or intravenous injections of a solution of table-salt have been found useful in relieving uræmic dyspnœa or eclampsia. (See also **Hypodermoclysis.**)

Sodium sulphide is recommended in the treatment of lead poisoning by M. Peyrou, given in the dose of 0.32 to 0.50 Gm. (or gr. v-viij) a day. The observation was based upon experiments upon animals and was confirmed by M. Quinquaud, who had observed that the salt named produced an increased elimination of lead in the urine. Sodium sulphide occasions the same result in mercurial intoxication, and must be regarded as an excellent eliminative agent in all cases of metallic poisoning.[1]

Sodium chlorate is praised as a remedy in the treatment of epitheliomata of the mucous membrane of the upper digestive passages. In a communication to the French Association for the Advancement of Science M. Brissaud stated that in cancer of the stomach he had obtained almost incredible amelioration by daily doses of 12 to 15.5 Gm. (or ʒiii-iv). Hæmorrhages ceased, cachexia disappeared, and the tumor vanished in the course of several weeks. He began with doses of 8 to 10 Gm. (or ʒii-iiss) per day and, if no improvement occurred, he increased the amount to 15.5 Gm. (or ʒiv). He does not employ the drug if the slightest degree of albuminuria is present. M. Lépine, at the same meeting, declared that in the dose of 15.5

[1] *Medical Bulletin*, Feb., 1894.

Gm. (or 3iv) sodium chlorate might cause the formation of methæmoglobin in the blood.

In a case of angina pectoris, Dr. Gingeot obtained good results from sodium iodide given in alternation with spirit of glonoin, the former being taken for six, and the latter for two, weeks. Gordon Sharp has employed the sodium nitrate in angina pectoris and irregular cardiac action, and, on account of its superior stability, recommends it as a substitute for amyl nitrite. The maximum dose is given as 0.32 Gm. (or gr. v), but it is stated that 0.065 to 0.13 Gm. (or gr. i-ij) is usually sufficient.

Sodium salicylate is used very largely in the treatment of acute rheumatism, and rheumatic throat inflammation, pyrexia of influenza, etc. In acute rheumatism, about 8 Gm. (or 3ij) a day, in divided doses, relieve pain and fever. Salicylate of sodium has been used in pneumonia for a number of years. According to Liegel,[1] 72 cases were treated among mining operatives with large doses of sodium salicylate: 8 Gm. (or gr. cxx) daily, or 0.65 Gm. (or gr. x) every two hours. Some of these cases were exceedingly unfavorable, occurring in persons of intemperate habits, and 2 of the patients were over 70 years of age. Not a single death occurred among these cases. A number of typical recrudescences were noted, but were easily controlled by the same agent. Dr. Sebring[2] treated 75 cases of pneumonia with salicylate of sodium in the same dosage, and lost but 1. Four of the patients were over 80, one being 84 and an habitual drunkard. There were also several cases of mitral and other valvular cardiac lesions. The patient who died was a plethoric woman who had been troubled with cardiac syncope for a long time before developing pneumonia. Of 125 cases treated, by other physicians, with salicylate of sodium, only 1 died. Dr. H. Radcliffe Crocker reports that he has frequently derived benefit from the use internally of sodium salicylate in psoriasis, especially in hyperæmic cases of recent development. He has also witnessed marked improvement follow its administration in a case of lupus erythematosus.[3] Germain Sée commends this salt as an efficient cholagogue, which increases the watery portion of the bile, and is therefore of value in promoting the expulsion of gall-stones. On the other hand, it has some disadvantages. Some patients cannot take it at all, as it is too irritating to the stomach. It often causes tinnitus aurium, and patches of erythema upon the skin. A case is reported in which, after taking 160 grains in 60 hours, it caused blindness in both eyes in a young girl suffering with acute rheumatism. The natural salt is less likely to cause such accidents than the synthetic or artificial salt.

Sodium salicylate, combined with theobromine, has such diuretic effects that it has been called **diuretin**, of which the dose is 4 to 6 Gm. (or 3i-iss) daily, in divided doses. (See **Theobroma**.) Good results may be obtained in fevers by using the fluid extract of erythroxylon coca to sustain the heart's action and support strength, at the same time that sodium salicylate is used to keep down temperature. After the administration of large doses of sodium salicylate, a crystalline deposit will sometimes form upon the skin. It is uncertain whether the crystals are of the unaltered drug or of decomposition-products. A neutral, or acid, sulphosalicylate of sodium has been pre-

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[1] *Wiener medicinische Wochenschrift*, May 7, 1898.
[2] *Medical Record*, April 22, 1899.
[3] *International Medical Magazine*, Aug., 1895.

pared. The acid salt is a white, crystalline powder, soluble in water, but almost insoluble in alcohol and ether. Its taste is less unpleasant than that of sodium salicylate, and it is said to be less apt to cause vertigo and buzzing in the ears. This preparation has been used with success in acute rheumatism.

Sodium nitrate in doses of 0.20 to 0.25 Gm. (or gr. iii-iv), is recommended by Pearce as serviceable in asthma. Dr. Angrisani, from an experience in 10 cases, considers sodium nitrate as of service in relieving maniacal excitement. He gave it in daily doses of 3 to 5 Gm. (or gr. xlv-lxxv). It was usually well borne and relieved high arterial tension, restlessness, and hallucinations. In two patients, who suffered from epilepsy of psychical origin, the attacks could be prevented by the administration of 6 Gm. (or ʒiss) of the remedy in a single dose immediately after the appearance of the aura.

Sodium nitrite is a white, opaque crystalline substance, of a mild saline taste and destitute of odor. It is a deliquescent salt, readily soluble in water and slightly soluble in alcohol. It is best administered in an alkaline solution on account of its liability to be decomposed by the gastric juice. The peculiar properties which this compound possesses depend upon the nitrous acid which it contains. Its physiological and therapeutical effects very closely resemble those of amyl nitrite. Of the pure salt the beginning dose should never exceed 0.13 to 0.20 Gm. (or gr. ii-iij). Sodium nitrite has afforded relief in a number of cases of epilepsy. In angina pectoris its action is akin to that of nitroglycerin and amyl nitrite, but is less quickly produced and is of longer duration. It may be beneficial in paroxysms of asthma and dyspnœa.

Sodium Glycocholate.—Important constituents of the bile are the glycocholates and taurocholates of sodium and potassium. It has been claimed that a deficiency of these compounds in the bile and blood causes the formation of gall-stones. The administration of sodium glycocholate acts as a cholagogue laxative. It is useful in jaundice (unless the duct is occluded). It is also valuable in cirrhosis of the liver, and in constipation caused by deficient flow of bile. The salt is given in doses of 0.30 to 1 Gm. (or gr. v-xv), three times a day. It may be continued for several months in cases with gall-stones. It is best given in capsule and may be combined with pancreatin.

Sodium Tellurate was brought forward by Neusser in 1890 as a remedy for the night-sweats of phthisis. It has been used in a number of cases by Professor Combemale, who found it efficient in single daily doses of about 0.065 Gm. (or gr. j). It is open to the reproach, however, of disturbing digestion and communicating a strong garlicky odor to the breath. Sodium tellurate is also able to suppress the sweating of rheumatism, typhoid fever, syphilitic phthisis, and dyspepsia.

A 1- or 2-per-cent. aqueous solution of sodium fluoride has recently been used with advantage as an antiseptic wash to the bodies of persons suffering from infectious disease, in the erythema of newborn infants, and as an injection in vaginitis and cystitis.

Sodium Cacodylate, it is reported,[1] has been employed internally in the treatment of various ocular affections with good results, particularly in rebellious herpetic keratitis. Galezowski has employed it locally in the eye in the form of an oily or aqueous collyrium as follows:—

[1] *Merck's Archives*, June, 1905.

℞ Cocainæ hydrochloridi ..... | 25 Gm. or gr. iv.
Petrolati liquidi ..... 15 | Gm. or ʒiv.
Sodii cacodylati ..... | 13 Gm. or gr. ij.

A few drops in the eye two or three times daily.

Sodium Eosinate.—Eosin is a dye obtained by the action of phthalic anhydride upon phenols. Soluble eosin is usually the potassium salt of this compound. The corresponding sodium salt ($C_{20}H_6Br_4O_5Na_2$) has been used in the treatment of epilepsy by Bourneville and Chapotin[1] in doses of 1 Gm. (or gr. xv) gradually increased to 3 Gm. (or gr. xlv). Under the larger doses the number of convulsions materially decreased, but toxic symptoms appeared, which required the treatment to be discontinued. They consisted in redness and swelling of the face and hands, followed by ulceration and by falling out of the nails.

SOLANUM CAROLINENSE.—Horse-nettle.

This plant belongs to the Solanaceæ, or Nightshade family, growing abundantly in the southern United States, and known under a number of popular names, as ground-potato, poison-potato, sand-brier, horse-nettle, etc. The fluid extract of the fruit is given in doses of 4 to 8 c.cm. (or ʒi-ij).

Kraus has isolated two alkaloidal principles, which he regards a **Solanine** and **Solanidine,** with an organic acid, **Solanic Acid.** According to Dr. E. Q. Thornton, solanum in large doses depresses the respiration and cerebrum, stimulates the spinal cord, but has no effect upon the circulation.

Dr. Napier, of Blenheim, S. C., who introduced this drug, regards it as diuretic, anodyne, and antispasmodic in its action; he also reports its use in convulsions of hysterical or uræmic origin and in traumatic tetanus.

Solanum has recently been restudied chemically, experimentally, and therapeutically by Dr. Morris C. Thrush (Inaugural Essay on "Solanum Carolinense," Medico-Chirurgical College, Philadelphia, May 18, 1901). Prof. F. Savary Pearce, quoted by Dr. Thrush, regards it of especial value in essential epilepsy, the attacks in the majority of cases being lessened in severity and number. The dose of the fluid extract of the berries is 4 c.cm. (or fʒj) four times a day, and increasing to 7.5 c.cm. (or fʒij) every four hours, no ill effects from this large dose being observed; the fluid extract is more desirable than the tincture, on account of the lessened quantity of alcohol.

SOLANUM PANICULATUM. — Jerubeba. Solanum paniculatum (Solanaceæ), or jerubeba, is a common, shrubby plant, which grows in the wild country of the north of Brazil. It has a woody stem, and reaches a height of eight or ten feet. The stem, branches, and under side of the leaves are almost covered by a white, downy hair. An alkaloid, termed **Jerubebine,** has been found in the fruit and the root. Dr. Domingos Freire, of Rio Janeiro, describes two resinoid principles obtained from this plant, one of which is inactive, while the second has a powerful purgative effect.

Physiological Action and Therapy.—The effects of jerubeba upon frogs and guinea-pigs have been investigated by Duprat. Torpidity soon came on after hypodermic injection of a hydro-alcoholic extract, and reflex move-

[1] *Progrès Médicale,* Jan. 6, 1900.

ments disappeared. Respiration was retarded, and the action of the heart slow and irregular. A minute quantity of jerubebine hydrochlorate, injected by Dr. Domingos Freire into a small bird, caused lethargy, with contracture of the extremities, followed by tetaniform convulsions and death. Jerubeba is an excellent laxative, and is said to be valuable in the treatment of habitual constipation. The drug is held in great esteem in Brazil, where it is considered tonic and alterative. In some cases of liver disease Dr. A. Michaelis found jerubeba to increase the appetite and relieve indigestion.

SOLIDAGO.—Solidago, Golden-rod. The Solidago odora (Compositæ), or fragrant golden-rod, is a conspicuous feature of autumn landscapes in the northern United States. It has many varieties, but the usual form is a wayside herb with a terminal spike, or one-sided raceme, of yellow flowers. The plant is yellowish green, fragrant, and yields, by distillation, a **volatile oil,** resembling anise in odor. The fluid extract, made with diluted alcohol as a menstruum, is often used as a flavoring excipient. A solid extract may be obtained by evaporating the fluid extract to the proper consistence and incorporating with it one-twentieth of its weight of glycerin.

Physiological Action.—Golden-rod is carminative and gently stimulant. The hot infusion produces diaphoresis and relieves the pains of dysmenorrhœa.

Therapy.—This drug is scarcely used by the profession, but possesses some, though not very decided, medicinal value. The decoction and warm infusion are used in domestic practice to produce diaphoresis, to relieve colic, and to promote menstruation. The oil may be used for similar purposes, and also as a carminative to relieve flatulence, etc.

SOMATOSE, an albuminous food-product prepared from fresh meat, and retaining the proteid elements in soluble form, has been largely used of recent years in wasting and exhausting disease, as a means of nourishing the sick. It is in the form of a light-brown powder, almost odorless, and not disagreeable to the palate. By adding a teaspoonful to a cupful of hot water a form of meat-extract or beef-tea is made which is acceptable to very delicate stomachs and even checks vomiting and nausea. It may be added to broth, coffee, gruel, or other food, in cases of typhoid fever, cholera infantum, etc. A combination with milk is also offered, **lactosomatose,** and one containing iron, **ferrosomatose,** which have a high therapeutic value in anæmia, debility, lactation, and other conditions requiring increased nutriment.

SOMNAL.—Ethylated Chloral-urethan.—In 1889, Dr. S. Radlauer, of Berlin, brought to the notice of the profession a compound of chloral, urethan, and alcohol which is considered a definite compound, and not a simple mixture of these substances. It is a colorless liquid, resembling chloroform in appearance; very slightly, if at all, soluble in cold water, but soluble in hot water and in alcoholic solutions. The odor is faint, resembling spirit of nitrous ether; the taste is very pungent. For administration it requires free dilution, and can be given with simple elixir, whisky, or syrup of licorice.[1]

[1] "Somnal: a New Hypnotic," by Frank Woodbury, M.D., *Dietetic Gazette,* July, 1890.

Physiological Action.—Dr. W. Gilman Thompson,[1] from a series of experiments, both physiological and clinical, concluded that "the effects of somnal are much more striking and certain than those of urethan, and far less depressing than those of chloral. There is no vertigo or depression after taking somnal, such as may follow the use of sulphonal. The blood-pressure is increased under somnal instead of being depressed, as it is after taking chloral. It does not disturb digestion, and does not affect the pulse or temperature. Ordinary doses cause the respiration to become slow and full, while after ingestion of a toxic amount the breathing is rendered shallow, rapid, and irregular.

An adverse opinion regarding this substance has been published[2] by Dr. Langgaard, who maintains that its narcotic effect is less than that of chloral, appears later, and is of shorter duration. Langgaard affirms that respiration and circulation are affected in the same manner, and, at least, as energetically as by chloral. The blood-pressure sinks, in rabbits, to 40 millimetres (15 $^{3}/_{4}$ inches) of mercury, or even lower, after doses that only produce two hours' light sleep.

Therapy.—Somnal has been recommended for cases of simple insomnia and sleeplessness after acute diseases, delirium tremens, parturition, etc. Dr. Evensen states, as a result of his experience, that somnal may be employed in chronic mania and quiet melancholia, but is without effect in acute mania. It should not be used in chronic interstitial nephritis and endarteritis with abnormally high tension, as it would increase the latter condition. Pain or cough is not much affected, though soothed by the sleep produced.

SOMNOFORM.—This name (proprietary) has been given to a mixture employed for general anæsthesia, containing ethyl chloride, 65; methyl chloride, 30; and ethyl bromide, 5 per cent. It is said to be largely used in France, being considered less dangerous than chloroform.

SOMNOS.—A trade name for chloraethanal alcoholate. Used as a hypnotic in doses of 4 to 15 c.cm. (3i-iv).

SOZOIODOL.—Di-iodo-para-phenol-sulphonic Acid. From phenol is derived, by combination with iodine and sulphuric acid, the remarkable substance, sozoiodol, which was first discovered by one of our own countrymen in San Francisco; but it was not until its manufacture was conducted upon a larger scale in Europe that it could be obtained sufficiently pure for medicinal use. The components of this remedy would indicate its value; it contains 55 per cent. of iodine, 20 per cent. of phenol, and 7 per cent. of sulphur. It forms salts with alkalies and with metals; those most used are potassium, sodium, mercury, and zinc. As manufactured in this country by the Mallinckrodt Chemical Company, of St. Louis and New York, in a pure form, the salts are generally perfectly white, odorless, and vary in solubility, the mercurial salt being the least soluble. The potassium salt, with 2 parts of talc or other inert vehicle, may be used as a substitute for iodoform, being free from all the objectionable features of the latter drug.

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[1] *New York Medical Journal*, Nov. 29, 1890.

[2] *Süddeutsche Apotheker-Zeitung*, Nov. 21, 1889; *Medical Bulletin*, Feb., 1890, p. 56.

Physiological Action. — The sodium and potassium sozoiodolates are non-irritating, and may be used in full strength as antiseptics and slight astringents; but dilutions with talc, sugar of milk, starch, etc., in the form of 10- to 25-per-cent. triturations, form very efficient dusting-powders as substitutes for iodoform. The mercurial and zinc salts are more active, and are used in solution (10 to 20 per cent.) for the same purposes. In solutions ranging in strength from $^1/_2$ to 2 per cent. sozoiodol and its combinations are destructive to the micro-organisms of suppuration. Sodium sozoiodol has been given to rabbits in doses of 1 Gm. (or gr. xv) without producing any toxic effect. Sozoiodol is not decomposed within the body, but passes through the organism unchanged. According to Buffalini, the quantity of urea eliminated after the ingestion of sozoiodol is materially diminished, though the amount of urine is increased.

Therapy. — As a topical application in uterine catarrh, or ectropion, Nitschmann praises the soda salt, which is to be blown directly on the cervix and a dry tampon placed over it. He also uses a 5- to 7-per-cent. solution in rhinitis hypertrophica, ozæna, acute coryza, and in inflammations of mucous membranes generally, applied in a douche or by means of a camel's-hair brush. Dr. Scharf, of Constantinople, and the late Dr. Guttmann, of Berlin, have reported good results from the insufflation of the nasal cavities with sodium sozoiodol in whooping-cough. About 0.25 Gm. (or gr. iv) was used each day. The number and the severity of the paroxysms were reduced within a few days, and in some cases the attacks ceased after about a week's treatment.

A 5-per-cent. sodium-sozoiodol solution has proved to be useful as a collyrium in acute purulent conjunctivitis and in ophthalmia neonatorum. The combination with zinc is commended in chronic inflammation of the ear and upper air-passages. Dr. Seifert, of Würzburg, has obtained satisfactory results in tuberculous ulcers of the larynx from insufflation of sodium sozoiodol diluted with an equal bulk of some innocuous powder, such as sugar of milk. The sozoiodol combinations have been applied with success, it is said, to unhealthy wounds and ulcers, parasitic skin diseases, eczema, impetigo, burns, dermatitis, and cracked nipples.

A 2-per-cent. solution of zinc sozoiodol is a useful gargle in stomatitis and pharyngitis. A 1-per-cent. ointment of mercury sozoiodol, made with lanolin, has proved a beneficial application to scrofulous and syphilitic ulcers. Gaudin employs a 4-per-cent. plaster of the mercurial salt as a dressing to chancres. Sozoiodol preparations have been advantageously employed in dentistry as disinfectant remedies. An interesting observation was made by C. Schwarz, who gave 2 Gm. (or gr. xxx) daily of sodium sozoiodol to a diabetic patient without any restrictions as to diet. The symptoms at once improved, the urine and sugar diminished, and in two months not a trace of sugar could be found.[1] Buffalini tried the drug in phthisis (1 Gm., or gr. xv, daily) without results.

The sodium salt has been recommended as a substitute for carbolic acid or creosote in cases of infectious dyspepsia, and may be administered in daily doses of 1 to 3 Gm. (or gr. xv-xlv). In affections of the external ear accompanied by free discharge Dr. Max Teichmann, of Berlin, reports good results from the use of potassium sozoiodol as a dusting-powder. Lithium sozoiodol has seemed to be beneficial in several cases of articular rheumatism,

[1] "Annual of the Universal Medical Sciences," 1890, vol. v, p. A-124.

the doses being the same as those of the sodium salt. For insufflation in ozæna, rhinitis, and rhino-pharyngitis, the zinc and mercury compounds may be used, diluted with considerable excess of milk-sugar; the sodium and potassium salts may be employed pure or diluted to 3- or 10-per-cent. solutions. If a prolonged action is desired, the potassium salt is used, either alone (10 per cent.) or mixed with talc or sugar. In urethritis or vaginitis the zinc sozoiodol, in 2-per-cent. solution, answers well as an injection, used several times a day.

SPIGELIA (U. S. P.).—**Spigelia (Pink-root).**

Dose, 4 to 8 Gm. (or 3i-ij) for an adult; 0.65 to 1 Gm. (or gr. x-xv) for a child of three years.

Preparation.

Fluidextractum Spigeliæ (U. S. P.).—Fluid Extract of Spigelia. Dose, 4 to 7.5 c.cm. (or f3i-ij) for an adult.

Fluidextractum Spigeliæ et Sennæ.—Dose for a child, 2 c.cm. (or 3ss); for an adult, up to 16 c.cm. (or 3iv).

Pharmacology.—Spigelia is named in honor of Adrien Spiegel, or Spigelius, an Italian botanist of the seventeenth century. Officially it is the "dried rhizome and roots of Spigelia marilandica (Loganiaceæ)," growing in rich soils near the woods. It is a native of the Southern States, and bears a scarpoid spike with funnel-shaped, sessile flowers, crimson externally and orange within, which appear in June. The roots contain a bitter principle, volatile oil, resin, etc., and W. L. Dudley found a volatile, crystallizable alkaloid, which he named **Spigeline.**

Physiological Action.—Spigelia is a popular anthelmintic against round worms. It has some cathartic action, but this is uncertain. When it does not produce purgation promptly, some symptoms of cerebral disorder, as vertigo, dimness of vision, strabismus, dilated pupils, even convulsions may appear. Therefore it is best to combine it with senna, or administer a dose of a saline, like magnesium sulphate, about two hours after taking spigelia. Moderate doses retard the pulse and diminish arterial pressure. Excessive amounts are capable of causing death by respiratory failure.

The combined fluid extracts of spigelia and senna (5 to 3), with aromatics, was formerly official, and is still used; dose, 4 to 7.5 c.cm. (or f3i-ij). In this combination the narcotic effects are obviated. An objection to this remedy is its color, which stains the child's clothing if it should vomit or have loose passages.

Full doses cause vomiting, diarrhœa, giddiness, stupor, dilated pupils, tremors, muscular contractions, convulsions, dyspnœa, and death. It is an acrid, narcotic poison.

Therapy.—This remedy ranks among the best of our agents for the destruction of lumbricoid worms. It has been employed as a vermifuge; and also in rheumatic affections of the heart and pericardium, and of the eye. In palpitation of the heart accompanying valvular disease, it has been used with asserted success in 0.60 c.cm. (or *mx*) doses of a tincture (12 per cent.).

SPIRITUS GLYCERYLIS NITRATIS (U. S. P.).—**Spirits of Glyceryl Trinitrate** (Spirits of Glonoin). An alcoholic solution, containing 1 per cent., by weight, of glyceryl trinitrate [$C_3H_5(ONO_2)_3$]. (See **Glonoin.**)

STAPHISAGRIA (U. S. P.), **STAVESAGRIÆ SEMINA** (B. P.).—**Stavesacre-seeds.**

Preparations.

Fluidextractum Staphisagriæ (U. S. P.).—Fluid Extract of Stavesacre. Not used internally.

Unguentum Stavesagriæ (B. P.).—Stavesacre Ointment (stavesacre-seeds, 40 Gm.; yellow wax, 20 Gm.; benzoated lard, 170 Gm.).

Pharmacology.—"The dried, ripe seed of Delphinium Staphisagria" (Ranunculaceæ), growing along the Mediterranean, contains several alkaloids, the most important being **Delphinine** and its decomposition products (Katz), **Delphinoidine, Delphisine,** and **Staphisagrine.** They also contain a bland fixed oil, which, when extracted by ether, is apt to be contaminated by the alkaloids.

Physiological Action.—Stavesacre is used principally for killing lice and the itch insect. It is irritating to the skin, producing erythematous inflammation when freely applied, and when taken internally is a narcotic poison, lowering the action of the heart, causing profound depression of the vital power and spinal paralysis, with death from asphyxia. A fatal result has even attended its local application to the scalp, when used too freely, in a child.

Charalampi (Inaug. Dissert., Dorpat) found that, although delphinine and delphisine have the same chemical composition, they differ slightly in their behavior to water, alcohol, ether, and benzol, but still more in their physiological effects. Delphinine has an acrid, benumbing taste, while delphisine is bitter, leaving a burning sensation on the tongue. Delphinoidine, which is amorphous, has a bitter, scarcely acrid taste, is soluble in ether, and yields amorphous salts, which are soluble in water. The mixture of principles insoluble in alcohol, which has been known hitherto as **Staphisagrine,** consists of at least four alkaloids, all of which are amorphous and have a bitter taste. The physiological action of the different alkaloids was determined by Professor Kobert. He found that they do not dilate the pupil; otherwise they resemble aconite, though decidedly weaker, differing among themselves in their effects. Delphinine shows a very close relation to aconitine. The lethal dose for cats is 0.0015 Gm. (or gr. $^1/_{40}$) of delphinine or 0.0005 Gm. (or gr. $^1/_{120}$) of delphisine; of delphinoidine the lethal dose was also 0.0005 Gm. (or gr. $^1/_{120}$), but it was more decidedly narcotic in its action.[1]

Therapy.—The use of stavesacre in medicine is restricted almost entirely to its effects as a parasiticide. The dry powder may be dusted over the affected surface, for head- or body- lice, or the following formula employed, which has been highly recommended:—

℞ Fluidext. staphisagriæ ..... 7|5 c.cm. or f℥ij.
Acid. acetici dilut. (vel aceti) .....q. s. ad 180| c.cm. or f℥vj.
M. Sig.: For pediculosis. If applied several times a day, usually effects a cure in two days.

The ointment may be used in scabies as a parasiticide, but its common employment is for the destruction of pediculi. Care should be taken not to apply it too freely, and to remove it at once upon the appearance of toxic symptoms. The oil has also been used for this purpose. Squire recommends the oil of stavesacre diluted with olive-oil. As suggested by Professor Leidy, any bland oil would answer the purpose, as lice are air-breathing insects, and

[1] *American Journal of Pharmacy,* Aug., 1890.

are suffocated by being immersed in oil; poison is therefore unnecessary. An ointment consisting of 1 part of the oil of stavesacre to 7 parts of lard has been found efficacious in prurigo senilis. **Delphinine** has been employed in painful affections, as in neuralgia, where an ointment (2 to 4 per cent.) may be applied over the course of painful nerves. Given internally (0.006 to 0.008 Gm., or gr. $^1/_{10}$-$^1/_8$), it was found to act as a cardiac sedative and to relieve excitement in acute rheumatism, by von Mering. It has also been used in asthma and as an antipyretic in the same doses. A decoction of stavesacre-seeds has sometimes proved effective as an anthelmintic, and Phillips[1] has known the tincture apparently beneficial in long-standing amenorrhœa and also in the nausea of pregnancy. Dr. W. B. Squire, of Worthington, Ind., uses stavesacre in irritable bladder with painful micturition.

STEARATES.—Stearic acid, prepared from suet, has been combined with copper, manganese, mercury, and zinc, forming powders which, in diseased conditions of the skin, can be used either in their own form or in ointments. Traces of other fatty acids are associated with the stearic acid.

Therapy.—The compound zinc stearate is a serviceable dusting-powder in intertrigo, hyperidrosis, and acute vesicular eczema. It is useful in allaying itching. A distinctive property of this body is that it adheres very closely to mucous surfaces and retains its position for hours, effectually preventing irritation by morbid discharges. This compound is employed as a vehicle for many other drugs. Mixed with boric acid, it is beneficial in bromidrosis, paræsthesia, ulcers, and eczema. The compound zinc stearate, mingled in various proportions with salicylic acid, is applicable to hyperidrosis, eczema rubrum, chancroids, and gangrenous wounds. The addition of tannic acid renders it advantageous in bed-sores and prolapsed bowel. With thymol iodide it is serviceable in atrophic rhinitis and ozæna. Dr. N. F. Brown has used this compound with advantage in acne, rosacea, and psoriasis; in vulvitis, vaginitis, and inflammation of the neck of the womb.

The compound zinc stearate with balsam of Peru may be employed by insufflation in tuberculous ulcers of the larynx. The union with chrysarobin is a good application in psoriasis; with cocaine it may be applied to the nasal passages in acute coryza and hay fever; with tar it is advantageous in chronic eczema and psoriasis; with resorcin it is of utility in parasitic skin diseases and syphilitic ulcers. A combination of compound zinc stearate with acetanilid in the proportion of 1 Gm. (or gr. xv) of the latter to 4 Gm. (or ʒj) of the former substance is a useful application to suppurating wounds, to which it serves at the same time as a deodorizing agent. Other active compounds of stearates have been prepared and placed upon the market by McKesson & Robbins, of New York. The compound mercury stearate is recommended for the relief of paræsthesia and as a substitute for other mercurial combinations. The compound manganese stearate is considered as preferable to the purified oxide.

STERCULIA. (See **Kola.**)

STILLINGIA (U. S. P.).—**Stillingia (Queen's Root).**

Preparation.

Fluidextractum Stillingiæ (U. S. P.).—Fluid Extract of Stillingia. Dose, 0.60 to 4 c.cm. (or *m*x-fʒj).

[1] *Op. cit.*, p. 48.

Pharmacology.—The dried root of Stillingia sylvatica (Euphorbiaceæ), an indigenous perennial, growing in the southern portion of the United States. The most noteworthy constituent is a soft resin; it also contains an alkaloid **Stillingine**, a bitter, acrid principle, and some volatile oil.

Physiological Action.—When taken in rather large doses, this drug acts as a severe cathartic and emetic. In small doses, frequently repeated, it is believed to stimulate various secretions so as to warrant its being considered alterative. It is also regarded as a stimulant to the heart and circulation. The fluid extract is a good preparation.

The National Formulary provides a compound fluid extract of stillingia, which also contains corydalis, iris, sambucus, chimaphila, coriander, and xanthoxylum. Dose, 4 to 8 c.cm. (or f3i-ij).

Therapy. — Stillingia has been employed as an alterative in syphilis, scrofula, and liver disorders. In syphilis it is more effective combined with other alteratives, such as clover, prickly ash, and sarsaparilla. In jaundice, hæmorrhoids, constipation, and disordered digestion from insufficient action of the liver, stillingia is valuable.

It has likewise been recommended in the first stage of hepatic cirrhosis and in ascites due to that disorder. Intermittent fever being frequently associated with torpid or deranged liver, the combination of this drug with antiperiodic treatment is very successful. The National Formulary gives a formula for a compound fluid extract which is a good vehicle and adjuvant for potassium iodide in syphilis, chronic rheumatism, etc. In various cachectic skin disorders also this combination is useful.

STOVAINE.—The trade-marked name for amylene hydrochloride. It is in glistening scales, which are freely soluble in water and in alcohol. Resembles cocaine in its action as a local anæsthetic, and has been used as a substitute for the latter in subarachnoid spinal injection, combined with adrenalin. The ordinary solution for local anæsthesia is three-fourths of 1 per cent. (0.215 Gm. to 30 c.cm., or gr. iii $^1/_4$ per ounce).

STRAMONIUM (U. S. P., B. P.).—**Stramonium-leaves.**

STRAMONII SEMINA (B. P.).—**Stramonium-seeds.**

Preparations.

Extractum Stramonii (U. S. P.).—Extract of Stramonium (leaves). Dose, 0.015 Gm. (or gr. $^1/_4$).

Fluidextractum Stramonii (U. S. P.).—Fluid Extract of Stramonium (leaves). Dose, 0.06 to 0.30 c.cm. (or *m*i-v).

Tinctura Stramonii (U. S. P.).—Tincture of Stramonium (made from the leaf, assayed 10 per cent. Each c.cm. contains about gr. $^1/_{50}$ of the mydriatic alkaloids). Dose, 0.30 to 1.20 c.cm. (or *m*v-xx).

Unguentum Stramonii (U. S. P.).—Stramonium Ointment (extract, 10 per cent.).

Tinctura Stramonii (B. P.).—Tincture of Stramonium (stramonium-leaves, 20 Gm., or gr. cccx; alcohol [45 per cent.], q. s. ad 100 c.cm., or f3xxvij). Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Extractum Stramonii (B. P.).—Extract of Stramonium (seed). Dose, 0.015 to 0.065 Gm. (or gr. $^1/_4$-j).

Pharmacology.—"The dried leaves of Datura stramonium (Solanaceæ), yielding, when assayed by U. S. P. process, not less than 0.35 per cent. of mydriatic alkaloids." The British Pharmacopœia admits also the seeds and an extract of the seeds. The plant is an annual with green stem, coarse, rank-smelling leaves, and white flowers; the seed-capsule is green and fleshy. It

grows wild in Europe and the United States, being commonly known here as Jamestown weed (Jimsun weed), or thorn-apple. The last name is unfortunate, for when the seeds are eaten by children poisoning occurs, sometimes with fatal result. It contains an alkaloid, **Daturine** (0.02 to 0.03 per cent.), which appears to be a mixture of hysocyamine with atropine, with a small proportion of hyoscine. Dose, 0.0005 Gm. (or gr. $^1/_{120}$).

Physiological Action.—The physiological properties of stramonium are very much the same as those of belladonna, except that the sympathetic system is more influenced by stramonium, the heart becoming irregular and more delirium being manifested under its use. It is held to be aphrodisiac in full doses. Stramonium is eliminated from the system by the kidneys. The toxic effects are not very different and the treatment is the same as for belladonna poisoning. (See **Belladonna.**) Stramonium will also frequently give rise to a scarlatiniform eruption.

Therapy.—The leaves of stramonium are sometimes used locally, in a poultice or fomentation, as an anodyne for engorged breasts, tumors, rheumatic joints, sprains, etc. The ointment is used for irritable ulcers, cancer, hæmorrhoids, fissures, and painful skin affections, especially around the anus. It is much better if made from the extract of the fresh leaves. When dried, they may be mixed with tobacco and smoked for asthma, the fumes being inhaled so as to enter the bronchial tubes, an attack being checked or materially alleviated in this manner. Some relief may be afforded, in the same way, in a case of biliary colic and the passage of a stone along the ureter, or gravel. About 1 Gm. (or gr. xv) may be mixed with an equal quantity, or more, of tobacco and smoked in a pipe, or made into a pastille, with a little nitre, and moistened with alcohol, or burned on a hot shovel in a closed room. Stramonium has likewise been administered internally in asthma with some sucess, but its action is much more uncertain when taken by the mouth than when inhaled.

In mania of acute character, puerperal or other, the tincture should be given in decided doses, every two to four hours, until physiological symptoms are manifested. In spasmodic neuralgia (tic douloureux) and various forms of visceral neurosis, dysmenorrhœa, etc., stramonium may be combined with other agents of the same group, or with opium.

In spasmodic cough, the tincture might be used as a substitute for belladonna, in small doses. Stramonium is sometimes given with advantage in chorea, epilepsy, and nymphomania. The remedy seems especially beneficial when the last-named affection is associated with depressed spirits. Chronic rheumatism is not infrequently benefited by its internal use.

STRONTII BROMIDUM (U. S. P.).—**Strontium Bromide.**
Dose, 0.20 to 0.65 Gm. (or gr. iii-x).

STRONTII IODIDUM (U. S. P.).—**Strontium Iodide.**
Dose, 0.32 to 0.65 Gm. (or gr. v-x).

STRONTII SALICYLAS (U. S. P.).—**Strontium Salicylate.**
Dose, 0.32 to 1 Gm. (or gr. v-xv).

Pharmacology.—Strontium combines freely with other elements, forming a long list of salts. The bromide (97 per cent. of pure salt), iodide (98 per cent. pure), and salicylate (98.5 per cent. pure) are freely soluble in water; the phosphate is not official, and is insoluble.

Physiological Action.—The physiological effects of strontium were but little known until the investigations of Dr. J. V. Laborde, who reported his results to the French Academy of Medicine, at the meetings of July 21 and 28, 1891. His experiments were made upon dogs and, in one instance, upon the human subject. He found that large proportionate doses of bromide, chloride, carbonate, and lactate of strontium could be administered without producing any deleterious effects. The lactate gave rise, in the dog, to marked diuresis. M. Ch. Féré, in an independent investigation relative to the comparative toxicity of the bromides when given by intravenous injection, ascertained that, in the rabbit, the potassium bromide is about five times as toxic as the strontium bromide. Strontium increases the appetite, digestion, and assimilation of animals. Its salts retard fermentation and putrefaction, and act as intestinal antiseptics. Laborde attributes to them an anthelmintic effect. The combinations of strontium are partially eliminated in the urine and fæces, but a portion is retained within the economy and deposited in the bones, liver, and, to a less extent, in the soft tissues.

Therapy.—Strontium bromide has been used with satisfactory results in epilepsy. It is well borne by the stomach, and has not as yet been productive of any of the phenomena of bromism. The paroxysms of hystero-epilepsy have also been controlled by this salt. In true epilepsy it is perhaps more efficacious than potassium bromide in diminishing the frequency of paroxysms. According to the experience of Dr. Berkley, the improved mental condition, lessened somnolence and excitability under the use of the strontium salt should lead us to prefer it to the other bromides. Anthony Roche, speaking from an extended experience with the bromide of strontium, stated that he had never met with a case in which this salt, given in the doses and method he mentions, had failed to diminish the number of attacks. In many instances, there had been no return for periods extending to three or four years. He usually commences the treatment by ordering 2 Gm. (or ℥ss), night and morning in some vegetable infusion. Should this dose not decrease the attacks, he rapidly increases it, until he finds the quantity which will suit the individual case. Where there is a warning of an attack, he directs the patient to take 2 Gm. (or ℥ss) at once and repeat this every hour, if required. In order to get the full effect of the remedy it should be given in large doses and continued for a long period. Some patients have taken 4 Gm. (or ℥j) daily for several years without any ill effects. In the diet, he, at first, prohibits the use of meat entirely, allowing only fish and vegetables, becoming less strict as the patients improve.

The digestive disturbances accompanying disease of the heart and kidneys are notably ameliorated by strontium bromide. The writer has witnessed marked relief follow its administration in nervous dyspepsia and gastralgia. In dyspepsia associated with excess of hydrochloric acid, strontium bromide produces rapid and decided relief. It has proved efficacious in cases where the acid was deficient. In nervous vomiting and dilatation of the stomach it is also beneficial. In acute catarrh of the stomach it has been found to control vomiting and allay pain. The writer observed improvement follow the use of the bromide in chorea. This salt also afforded signal relief in senile pruritus. Germain Sée, in albuminuria, administers with good effect strontium bromide and calcium bromide alternately, in doses of 4 to 5 Gm. (or gr. lx-lxxv) in the course of the day.

Strontium bromide should not be administered in combination with sodium bicarbonate, as a double reaction takes place between the salts.

Strontium lactate is of decided service in albuminuria. It generally causes a rapid reduction of the albumin, but its administration should not be too soon suspended. Strontium is not a positive diuretic in man, though in several cases the writer has seen a pronounced diuretic effect from the use of the lactate. The lactate is efficacious in scrofulous, gouty, and rheumatic nephritis, in the albuminuria of pregnant and puerperal women, and in that of cardiac origin, but is of no service after the manifestation of uræmia. According to Constantin Paul, strontium is only useful in the parenchymatous forms of renal disease. It is of especial value where it is desired to moderate the loss of albumin. The formula, recommended by Gaucher and Gallois[1] is: lactate of strontium 50 Gm. (or ʒxiij); water, 375 c.cm. (or f3xc); the dose to be 45 c.cm. (or f℥iss) *per diem*, equivalent to 2 Gm. (or ʒss) of the strontium salt three times a day. Strontium lactate is of utility in subacute or chronic gout and rheumatism. In eczema dependent upon Bright's disease and psoriasis due to a rheumatic diathesis, strontium lactate effects improvement. It is advantageous in chronic gastric and intestinal catarrh. Dr. A. Ried believes that the diuretic power of this salt is sufficient to constitute a valuable temporary substitute for the salicylates in the treatment of pleuritic exudations.

Strontium iodide is much better tolerated than potassium iodide, and is not apt to give rise to gastric irritability or eruption upon the skin. This salt is an excellent remedy in certain constitutional disorders. It is valuable in the treatment of enlarged lymphatic glands, scrofuloderma, chronic abscesses, disease of bones and joints, in scrofulous otorrhœa, ozæna, or ophthalmia. Lichen scrofulosum, strumous acne and eczema, and other affections of the skin occurring in scrofulous subjects, are improved by the administration of strontium iodide. It is likewise beneficial in chronic eczema with excessive infiltration and thickening of the skin. It is a good systemic remedy in lupus vulgaris and in the early stage of tuberculosis.

Rheumatic manifestations often yield promptly to strontium iodide. It is of particular service in subacute, chronic, and muscular rheumatism. Sciatica and trifacial neuralgia dependent upon a rheumatic basis will often yield to this remedy. It is likewise of avail in subacute and chronic gout. Eczema, erythema multiforme, erythema nodosum, purpura rheumatica, psoriasis, and paræsthesia, caused by gout or rheumatism, are benefited by the use of this salt. The writer has seen good results from its employment in large pustules of the scalp, tubercular syphilide, and in all the later manifestations of syphilis. Strontium iodide is useful in chronic bronchitis, asthma, chronic catarrhal pneumonia, and chronic pleurisy. It will probably be found of avail in the first stage of cirrhosis of the liver or kidney. It is useful in chronic lead or mercurial poisoning. It may be employed in aortic aneurism, and Germain Sée recommends it in various affections of the heart. Experience has shown it to be useful in arteriosclerosis and angina pectoris. MM. Laborde and Malbec conclude that strontium iodide has a manifest influence upon the heart and is of service in affections of the myocardium, lesions of the aortic orifice, and the arteries. This salt can be safely

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[1] *Lancet*, April 25, 1896.

given in comparatively large doses, and is well adapted to take the place of potassium iodide whenever the latter salt is not well borne.

Strontium nitrate, in 2 Gm. (or ʒss) doses, has been advantageously used in articular rheumatism. Laborde regards strontium phosphate as an excellent nutritive and tonic agent. Strontium acetate is said to be an efficient tæniacide, given in a 15-per-cent. solution in water and glycerin, the dose being 30 c.cm. (or fʒj) daily for five consecutive days.

Strontium salicylate has been employed in flatulent dyspepsia and in various conditions of intestinal fermentation, in muscular and subacute rheumatism and chronic gouty manifestations accompanied by digestive disturbance. It is said to be well borne and to improve digestion. This salt is given in doses of 0.32 to 0.65 Gm. (or gr. v-x) after meals and is best administered in capsules.

STROPHANTHUS (U. S. P.).—**Strophanthus.**

STROPHANTHI SEMINA (B. P.).—**Strophanthus-seeds.**

Preparations.

Tinctura Strophanthi (U. S. P., B. P.).—Tincture of Strophanthus (10 per cent.; B. P., 2 1/2 per cent.). Dose, 0.12 to 1 c.cm. (or *m*ii-xv). B. P., up to 4 c.cm. (or f3j).

Extractum Strophanthi (B. P.).—Extract of Strophanthus (50 per cent., with milk-sugar). Dose, 0.015 to 0.065 Gm. (or gr. 1/4-j).

Strophanthinum (U. S. P.).—Strophanthin. Dose, 0.0003 Gm. (or gr. 1/200).

Pharmacology.—"The dried, ripe seeds of Strophanthus Kombé, deprived of their long awns (Apocynaceæ)" (U. S. P.): "The dried, ripe seeds of Strophanthus Kombé" (B. P.). From this African plant the natives make a toxic extract known as the Kombé arrow poison. Strophanthin is officially defined as a glucoside, or mixture of glucosides, obtained from strophanthus (U. S. P.). The strophanthin from S. hispidus, and S. gratus differ somewhat, and H. Thoms suggests that they should be distinguished by an initial, thus Kombé strophanthin would be K-strophanthin, and the others h-strophanthin, and g-strophanthin, respectively.

Strophanthin, having the formula $C_{31}H_{48}O_{12}$ (Arnaud) is believed to be the only active constituent of Strophanthus hispidus and Strophanthus Kombé. Strophanthin, like other glucosides, is easily decomposed by acids. It hydrolyzes, when heated with very dilute hydrochloric acid, to two forms of sugar and to **Strophanthidin.** Strophanthin is precipitated by tannic acid. It is readily soluble in water and alcohol, but almost insoluble in ether and chloroform. Pure or impure strophanthin, or pharmaceutical preparations containing the glucoside, when brought in contact with sulphuric acid, a trace of ferric chloride being present, yield a bright-green color. The crude drug may contain other varieties than the official Kombé seeds. Holmes, who has given this point much attention, claims that only by purchasing the seeds in the follicle and testing a seed from each follicle, can a reliable preparation of strophanthus be made. An assay based on the amount of extractive contained in a given tincture of strophanthus, or other preparations of the heart-tonic, is of little value to the physician, since the extractives consist largely of chlorophyl and other inert substances.

H. Thoms[1] reports that the drug contains, besides strophanthin, small quantities of **choline** and **trigonelline**—a base found in fenugreek.

The active principle, **Strophanthin,** is a crystallizable glucoside present in different parts of the plant, but especially in large proportion in the seeds, which are official. It is bitter, acidulous, insoluble in ether and chloroform, but soluble in alcohol and in water. A good fluid extract would probably be the best preparation, but the effects of the tincture have been most observed by Professor Fraser,[2] of Edinburgh, who first introduced it to the profession in 1870. Strophanthin may be administered simply dissolved in water, the dose being 0.0002 to 0.0003 Gm. (or gr. $^1/_{300}$-$^1/_{200}$). Bartholow advised chloroform-water as a solvent, in order to prevent the formation of penicillium.

Physiological Action.—Strophanthus has no local action, apart from the observation of Steinbach that an infusion of the seeds caused anæsthesia when applied to the cornea. This local action has been studied by Gley[3] and is common to both ouabain and strophanthin, but is more decided in the former substance. Three or 4 drops of a solution of 1 to 1000, dropped into the cornea, anæsthetizes it for a considerable time, which may extend to several hours. The effects are unaccompanied by any irritation of the conjunctiva. Strophanthin and ouabain are much more powerful local anæsthetics than cocaine, and the anæsthesia which they produce is total, including all varieties of sensibility. The feeling of heat and cold is the last to be extinguished and the first to revive. The drug, however, causes passive hyperæmia and may give rise to cloudiness of the cornea. Ouabain obtained from Strophanthus glaber is not identical with strophanthin, and Fraser suggests that it be called **acocantherin.**

E. M. Houghton[4] has also directed attention to the variability in physiological activity of different specimens of strophanthus, and advocates pharmacological assay, using frogs to determine the maximum and minimum dosage. Not only is the crude drug often found mixed with other vegetable substances, but the strophanthin supplied by different manufacturers is also unreliable, because he found one sample ninety times as strong as another. As strophanthin is declared to be three times as poisonous as atropine, ten times as poisonous as strychnine, and twelve times as poisonous as absolute hydrocyanic acid, extreme caution is advised in prescribing it, and to secure a standard preparation.

Strophanthus is bitter, and promotes appetite and digestion, if given in small doses. Its principal use is a cardiac tonic, resembling digitalis. It slows the heart-beat, lengthens the intervals between the contractions, and increases the energy of the muscular tissue. Some effect is also seen upon the arteries, but the rise of blood-pressure is due principally to the increased force of the cardiac contractions. In fatal cases the heart's action is arrested in diastole. Strophanthus is described by Binz, as differing from digitalis in acting more quickly, in not disturbing the intestinal canal, and

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[1] *Ber. d. Deutsch. Chem. Ges.*, 1898, 271.

[2] *British Medical Journal*, Jan. 22, 1887, and "Transactions of the Royal Society of Edinburgh," vol. xxxv, part iv (No. 21), 1890.

[3] *Le Progrès Médical*, Nov. 16, 1889, and March 1, 1890; *Medical Bulletin*, March 1890, p. 92, and June, 1890, p. 218.

[4] "The Pharmacologic Assay of the Heart-tonics," *Journal of the American Medical Association*, Oct. 22, 1898.

in not possessing a cumulative action, but the good effects are said to be not so lasting. A quieting effect on the brain and medulla is attributed to strophanthus. It has some diuretic power. In regard to the claim that it has no cumulative effect, this, as pointed out by Bartholow, must largely depend upon the interval between the doses, for if they are given too frequently the effects must overlap each other. The prolonged use of strophanthus sometimes gives rise to diarrhœa. In animals poisoned by strophanthus there is found marked evidence of irritation of the gastro-intestinal tract, with irritation or inflammation of the kidneys.

Therapy.—Strophanthin has been employed as a local anæsthetic, administered percutaneously by means of cataphoresis, the anode being moistened with the solution, or a tissue-paper disk used containing 0.00025 Gm. (or gr. $^1/_{250}$) or more, and a current of 5 to 8 milliampères employed.[1] Reynold W. Wilcox, from an extended experience with this agent, says that strophanthus was first brought to the notice of the French Academy of Medicine in 1865, but its first practical demonstration as a valuable heart-remedy came twenty years later, when Fraser published the results of his long-continued and patient researches. With wider and more rapid dissemination of knowledge, we may hope that, within a comparatively few years, we may have strophanthus used as carefully as digitalis to-day. That it possesses distinct advantages over the latter drug is undoubted, and it is equally certain that it is free from the greatest danger which the use of digitalis entails—namely, vasoconstriction. Success in the administration of strophanthus requires: 1. An active, well-made preparation from a reliable source. 2. Avoidance of its use in fully or overcompensated hearts, in those which present advanced muscular degeneration or mechanical defects of high degree. 3. The use of not too large or too frequently repeated doses; the dose of 0.30 c.cm. (or *m*v) of a reliable tincture three or possibly four times a day is sufficient.

In conclusion, Wilcox holds that, considering the limitations just enumerated, strophanthus is the drug of choice in: 1. All cases in which we wish to establish compensation. 2. All cases of arterial degeneration in which a remedy which causes more energetic cardiac contractions is required. 3. All cases of cardiac disease where diuresis is necessary. 4. All cases of weak or irritable hearts. 5. All cases of cardiac disease in childhood or old age.

Strophanthus is especially useful in the progressive heart-failure of elderly patients, with attacks of dyspnœa simulating angina. It is a serviceable cardiac stimulant in typhoid fever, and some authorities advocate its employment in angina pectoris. It can be prescribed thus:—

℞ Tinct. strophanthi,
Tinct. nucis vomicæ,
Tinct. cardamomi ..... aa 4| c.cm. or f3j.
Aquæ menth. pip. ..... q. s. ad 150| c.cm. or f3v.
M. Sig.: A teaspoonful or two every two or three hours.

At a meeting of the Edinburgh Medical Society (May 6, 1896) Dr. G. W. Balfour, on the contrary, expressed skepticism as to the medicinal value

[1] *Fortschritte der Medizin*, Feb. 1, 1890. Also see article by Frederick Peterson, on "A Farther Study of Anodal Diffusion as a Therapeutic Agent," *Medical Record*, New York, Jan. 31, 1891.

of strophanthus in cardiac affections. Experience shows that many, if not most, cardiac cases in hospitals require no treatment but rest. Drugs only are of permanent value which increase the elasticity of the myocardium, and this action could only be permanent when accompanied by a corresponding improvement in the general metabolism. This action is typically preserved by digitalis, the elasticity in the myocardium is increased, and this is accompanied by a rise in the general blood-pressure. The only other member of the digitalis group which had succeeded in obtaining general recognition is strophanthus, but its action is essentially different from digitalis.

The intravenous administration of strophanthin is recommended by M. A. Fraenkel[1] in dose of 0.00075 Gm. (or gr. $^1/_{85}$) in sterile water. The effect of the injection is seen in three or four minutes. In a case of non-compensated heart lesion, the pulse becomes slower, dyspnœa disappears, and free diuresis occurs. The grave symptoms of asystole are promptly relieved. The injections should not be too frequently repeated, as the remedy has the same cumulative action that is seen in all the other members of the digitalis group. Strophanthin does not have much effect on the arterial pressure, but it increases the amplitude of the pulse, causing the slowing of the rate and the diuresis.

Venous stasis is often relieved by a single injection; the effect, however, does not last more than two or three days. It should be supplemented, therefore, by the internal administration of digitalis. Fraenkel considers the intravenous injection as a prompt and powerful cardiac stimulant of great value in urgent cases: but not to be considered as taking the place of the internal administration of digitalis, when the treatment is to be continued for any length of time.

Strophanthin may also be administered hypodermically, in doses of 0.0006 Gm. (or gr. $^1/_{100}$), not more than once daily. The hypodermic injections are useful in chills, especially those of nervous character, such as chills due to urethral shock, following passage of a sound or an operation; also in malarial or nervous chills.

In Bright's disease, the symptoms of uræmia and dyspnœal attacks are rapidly relieved by strophanthus, which also reduces the dropsy of chronic kidney disorder. For exophthalmos, with irregular overaction of the heart (Graves's disease), it has been successfully tried. Dr. E. D. Ferguson[2] says that in eight cases out of nine, to which he gave strophanthus in exophthalmic goitre, there was marked relief; the other one had pre-existing pulmonary disease. He thinks it a probable explanation that strophanthus relieves the overtaxed heart by overcoming resistance in the systemic circulation. He advises beginning with doses of 0.50 c.cm. (or *m*viij), and gradually increasing them to 1.55 c.cm. (or *m*xxv), of a good tincture, several times daily.

Dr. William A. Hammond, in an article in the *Therapeutic Gazette*,[3] on "Weak Heart and its Treatment," considered strophanthus a valuable remedy, though inferior to digitalis, and stated that it appeared to him "to bear the same relation to digitalis that brucine does to strychnine, and when administered with a view to its tonic effect upon the heart it should be given

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[1] Proceedings International Medical Congress at Lisbon, 1906; *La Semanie Medicale*, May 2, 1906.

[2] "Proceedings N. Y. Medical Association," Oct. 22, 1890; *Medical Record*, Nov. 1, p. 592.

[3] Oct. 15, 1890, p. 668.

in much larger doses than those ordinarily prescribed." Hare suggests its use in children, where digitalis does not answer well; but Demme holds the view that in children more care is needed in using strophanthus than in using digitalis,[1] stating that the toxic effect of strophanthus on the heart-muscle often occurs unexpectedly and more suddenly than with digitalis. In the case of very young children, Demme observed strophanthus to cause indigestion. If it cause nausea and cold sweating, it should be withdrawn, and coffee and brandy be administered. On the other hand, Moncorvo, of Rio Janeiro, also an excellent observer, values strophanthus as a cardiac stimulant and diuretic, especially in the diseases of children. He considers it prompt and energetic, but devoid of danger, and claims that its good effects last long after the cessation of its administration. The sedative effect of strophanthus, although not very marked, has been noticed. It has been proposed to utilize it previous to the production of anæsthesia by chloroform, so as to lessen the stage ofexcitement. Dr. Feilchenfeld,[2] of Berlin, gives 0.30 c.cm. (or *m*v) of tincture of strophanthus on two evenings and the morning before operating. He regards it, in such cases, as more suitable than the bromide of potassium.

Strophanthus has also been found useful in bronchial asthma and whooping-cough.

In the treatment of psoriasis, the author has had some good results, especially when the integument is much congested, from strophanthus, with nux vomica:—

℞ Tinct. strophanthi,
Tinctura nucis vomicæ ..... aa 7|5 c.cm. or f3ij.

M. Sig.: Ten to twenty drops in water three times a day.

Dr. William Gemmel, of Glasgow, has made use of ouabain in 49 cases of whooping-cough.[3] He found it, when cautiously employed, to be of notable benefit in all stages of the disease. It is destitute of cumulative action. In an uncomplicated case it reduces the pulse, temperature, and respiration a little below the normal. Ouabain increased the activity of the skin. The bowels were unaffected. The excretion of urine was slightly increased. The appetite and the general condition were considerably improved. Sleep was sound while ouabain was being administered. This substance appears to be clinically closely related to the official strophanthin.

Dr. Gemmell states that the dose of ouabain, to begin with, should not exceed 0.00006 Gm. (or gr. $^1/_{1000}$) every three hours (0.0005 Gm., or gr. $^1/_{125}$, daily). For children under one year of age, not more than 0.00003 Gm. (or gr. $^1/_{2000}$) should be given every three hours. From the sixth to the twelfth year, if the symptoms are severe, 0.000125 Gm. (or gr. $^1/_{500}$) may be given in each dose, but the action must be carefully watched. Ouabain may be administered alone, dissolved in water, or in combination with potassium bromide or chloral-hydrate. The simplest way is to dissolve 0.065 Gm. (or gr. j) of ouabain in distilled water, so that each 0.06 c.cm. (or *m*j) of the solution shall be equal to 0.00006 Gm. (or gr. $^1/_{1000}$) of ouabain. Thus:—

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[1] "Annual of the Universal Medical Sciences" for 1890, vol. v, p. A-126.
[2] *Lancet*, March 3, 1900.
[3] *British Medical Journal*, April 26, 1890, p. 950.

℞ Liq. ouabain.	3	c.cm. or *m*xlviij.
Syr. aurantii	15	c.cm. or f℥iv.
Aquæ	q. s. ad 180	c.cm. or f℥vj.

M. Sig.: A teaspoonful every three hours.

STRYCHNINA (U. S. P., B. P.).—**Strychnine.** (See **Nux Vomica.**)

STYPTICIN.—Cotarnine hydrochloride has received the special title stypticin, owing to its power of controlling hæmorrhage. It is derived from narcotine by the action of oxidizing agents, narcotine being an opianate of cotarnine. The hydrochloride of cotarnine is a microcrystalline, yellow powder, with an intensely-bitter taste. Edmund Falk, of Berlin, found that physiologically it acts upon the motor portion of the spinal cord as a paralyzing agent, it is slightly narcotic, it has no direct action on the heart or blood-vessels. On the respiratory centre, after a transitory irritant action, it is a paralyzing agent, a fatal termination being induced in this way. Rousse and Walton claim a tonic action on the circulatory system, and assert that it acts as a cardiac stimulant. It is useful in pulmonary and especially uterine hæmorrhage. It may be given by the mouth in doses of 0.03 to 0.32 Gm. (or gr. ss-v), but is generally given hypodermically. In hæmorrhage from uterine cancer the results were negative.

STYRAX (U. S. P.).—**Storax, Liquid Storax.**
Dose, 0.65 to 1.30 c.cm. (or gr. x-xx).

STYRAX PRÆPARATUS (B. P.).—**Prepared Storax.**

Preparation.

Tinctura Benzoini Composita (U. S. P., B. P.).—Compound Tincture of Benzoin. Dose, 2 to 4 c.cm. (or f℥ss-j).

Pharmacology.—"A liquid balsam prepared from the wood and inner bark of Liquidambar orientalis" (Hamamelidaceæ), or Oriental sweet gum, growing in Asia Minor. The British Pharmacopœia directs that the balsam be obtained from the trunk of Liquidambar orientalis, and purified by solution in ethylic alcohol, filtration, and evaporation of the solvent. Styrax, which is a true balsam, contains a volatile oil, **Styrene, Cinnamic acid,** and **Styracin** (Cinnamyl cinnamate). The most important constituent of storax is probably **Storesin,** existing both uncombined and as a cinnamic ether. **Styrone** is a derivative of styracin, and is chemically cinnamic, or cinnamylic, alcohol.

Therapy.—Mixed with two or three parts of olive-oil, storax is used in treating scabies, and in some cutaneous diseases requiring slight stimulation. Storax is a good application to foul ulcers, and, made into an ointment, is an excellent dressing to the ulcers of frost-bite. It is a stimulating expectorant in chronic bronchitis, generally used, however, in combination, both internally administered and by inhalation, the tincture being volatilized by hot water. Storax has also been brought forward as a remedy for gonorrhœa and gleet, for chronic catarrhal affections of the genito-urinary organs, and been found useful in amenorrhœa. **Styrone,** or cinnamylic alcohol, is an efficient antiseptic, and its use has been enthusiastically advocated.[1]

[1] "Styrone: A Consideration of its Value as an Antiseptic," by H. H. A. Beach, M.D., *Boston Medical and Surgical Journal,* Aug. 1 and 8, 1889.

It is a prompt deodorizer of foul wounds or ulcers,—malignant or not,—and in bronchial catarrh it can be used in a spray:—

℞ Styronis ..... 4| c.cm. or f3j.
Glycerini,
Aquæ destillatæ ..... aa 30| c.cm. or f3j.
M. For external application.

Being non-poisonous, styrone can be used in emulsion with olive-oil or water for injecting into cavities, as after the operation for empyema; and, having an agreeable, cinnamon-like odor, it has been utilized in dentistry. Various combinations of styrone are suggested, as with liquid petrolatum, 1 to 12, which was used with success upon the dressings, as an antiseptic, after removal of the female breast.

Dr. Beach suggests the internal use of styrone in the treatment of cholera for the disinfection of the alimentary canal. It may also be substituted for carbolic acid in gargles, requiring antiseptic action and probably would be a useful enema for oxyurides or ulceration of the rectum. A solution of 1 to 60, containing a small amount of glycerin, would be well suited for internal use. Styrone is likewise an excellent deodorant and disinfectant in cases of purulent inflammation of the ear.

SUBLAMINE.—Ethylenediamine Mercury Sulphate is a white powder, readily soluble in water. It is used locally as a disinfectant for the hands in surgery and gynecology (1-to-5000 to 1-to-500 solution). Internally is used for syphilis (1- to 3-per-cent. solution. Dose, *m*xv or 1 c.cm.). Also used as a fixative for anatomical specimens in a 10-per-cent. solution. In the treatment of ringworm it has been used by Dr. Gottheil, of New York (1-to-750 to 1-to-1000 solution), and regarded as the most effective treatment.

SUCCINUM.—Amber. Amber is a resin found among fossil alluvial deposits in different parts of the world, representing the resinous exudation of a number of varieties of extinct coniferous trees. The amber consumed in this country is brought from the ports of the Baltic, but it has been found in small quantities in New Jersey and Maryland. It is a light-yellow, brittle solid, in irregular masses, resembling colophony. Water and alcohol scarcely act on it. It becomes negatively electrified by friction. By distillation **oil of amber** and **succinic acid** are obtained, and by repeated distillations from nitric acid it yields a liquor from which ether separates **borneol**, or pure camphor. Amber also contains a yellow resin, another resin, and a bituminous principle, the latter constituting about 80 per cent. It also contains a yellow coloring matter. The oil of amber has been so largely adulterated that it is little used and is no longer official.

Physiological Action.—The rectified oil of amber (oleum succini rectificatum, formerly official) is stimulant and antispasmodic, and excites the secretions of the bronchial mucous membrane and kidneys. Locally it is counter-irritant.

Therapy.—The volatile oil of amber has been used as a counter-irritant to the chest in cases of whooping-cough, and has also been applied to the back, along the spine, for certain spasmodic affections, such as chorea and infantile convulsions. It is a useful ingredient, in liniment, for chronic rheumatism, though probably inferior to oil of turpentine. It has also been used

as an embrocation in chronic bronchitis. Internally it has been given for amenorrhœa, digestive disorders, with pain, but is rarely prescribed at present. Flatulent dyspepsia may be relieved by the use of this remedy. Dose, 0.30 to 1.20 c.cm. (or *m*v-xx). The oil of amber has likewise been found of avail in spasmodic affections, as hysteria, hiccough, whooping-cough, and asthma.

SULPHAMINOL.—Thio-oxy-di-phenyl-amine. When the salts of oxydiphenylamine, dissolved in water, are exposed to the action of sulphur, a yellow powder is precipitated, which is without taste, odorless, readily dissolves in alkaline solutions; and in alcohol, with acetic acid, it forms yellow salts. In contact with animal liquids, sulphaminol, like salol, is split up into its components, forming nascent sulphur and phenol.

Physiological Action.—From its nature it is inferred that it is an active intestinal and systemic disinfectant. It is excreted by the urine, being converted again into oxydiphenylamine. Professor Kobert found that in animals it is comparatively innocuous, even in doses of more than 0.50 Gm. (or gr. viiss) for each pound of body-weight. He also declares it to be without poisonous properties when administered in the human subject.

Therapy. — Sulphaminol has been tested as a disinfectant by Dr. Schmidt, of Frankfort, in laryngological practice, and found to be a good deodorizer, as well as antiseptic. It favors the repair of wounds, and is said to be of special value in the after-treatment of operations upon the nose. Clinical observations in other fields of practice are wanting. It should be a good intestinal disinfectant in cholera Asiatica and summer cholera; also in typhoid fever, dysentery, diarrhœa, infectious dyspepsia, cystitis, etc.

SULPHONETHYLMETHANUM (U. S. P.).—**Sulphonethylmethane**, or **Trional.**

SULPHONMETHANUM (U. S. P.).—**Sulphonmethane.**

SULPHONOL (B. P.).

Dose, 0.65 to 1 Gm. (or gr. x-xv).

Pharmacology.—This is a synthetical compound, first manufactured in Germany, by Baumann; chemically it is diethyl-sulphon-dimethyl-methane. It is a whitish, crystalline solid, without odor or taste, soluble in 100 parts of cold water and in 18 or 20 parts of hot water. It is generally administered in hot broth, coffee, or milk. The insolubility and slow rate of absorption of this substance, particularly when given in capsules or suspended in a mucilage, are accountable for much disappointment in the use of the drug. It was advised by D. D. Stewart that the dose be given at bed-hour, and that the sulphonal be completely dissolved in boiling water, and drunk as soon as it has been cooled to a temperature which can be borne. At this point not the slightest precipitation occurs. The solution, if desired, may be flavored with some such *liqueur* as *crême de menthe* ("green-mint cordial"). Sulphonal is soluble in alcohol, ether, and chloroform.

Physiological Action and Toxicology.—Sulphonal is an hypnotic. The committee, of which Dr. T. Lauder Brunton was chairman, appointed by the British Medical Association to determine the relative value of the different hypnotics, especially with regard to the certainty of their action and question of tolerance, reported[1] that sulphonal was an efficient hypnotic in doses of

[1] *British Medical Journal*, July 26, 1890; *Therapeutic Gazette*, Oct., 1890, p. 623.

0.65 to 1.30 Gm. (or gr. x-xx), given at night, and that it was generally well borne, and its effects were not lost during periods of several months. In a case of chronic gout 2 Gm. (or gr. xxx) produced no effect. In six out of ten cases, in which 1.30 Gm. (or gr. xx) had been given, disagreeable after-effects were noted; drowsiness the following day was observed six times, giddiness four times, and headache and inco-ordination of gait, each twice. In seven cases, with 2 to 4 Gm. (or gr. xxx-lx), drowsiness was noted four times, giddiness twice, headache twice, inco-ordination of gait and vomiting, each once. Several cases showed that a second dose on the succeeding night (1.30 Gm., or gr. xx) has a greater effect than on the first night. In some cases prolonged use of the drug seems to diminish its effects. Thus, in a case (asthma and bronchitis) 1.30 Gm. (or gr. xx) were given every other night for eight weeks. During the first fortnight sleep came on in an hour and lasted twelve hours each night. The drug was then omitted for a week, when the insomnia returned. In the succeeding five weeks the drug, after three hours, produced six hours' sleep. In a case of phthisis 1.30 Gm. (or gr. xx) were given every other night for twenty-six days, except for five days, when the dose was reduced to 0.32 Gm. (or gr. v), but afterward was increased. During the time the patient was taking 1.30 Gm. (or gr. xx), after an hour he slept for six hours. The drug was omitted for a fortnight, and, on recommencing it only drowsiness and no sleep followed. In a case of neurasthenia with insomnia, quoted by Mr. Priestly, sulphonal, 0.65 to 1.30 Gm. (or gr. x-xx), did not lose its effect during six months.

Smith, of London, finds that, while under the influence of the drug the amount of urea and the quantity of urine are each slightly increased, no evidence of marked destructive action upon nitrogenous tissues exists. According to Mackenzie, the phosphates in the urine are increased by small and diminished by large doses of sulphonal.

In moderate doses the drug is completely changed during its passage through the body into a sulphureted organic substance. Dr. William F. Shirk, of Easton, Pa., finds that sulphonal acts especially upon the higher nerve-centres. It produces relaxation of the muscles and a staggering gait. Motor nerves are unaffected. Little, if any, effect was exerted upon the circulation or the composition of the blood; upon the respiration the drug is depressant. Dr. J. P. Crozer Griffith reported a number of cases where the after-effects were more or less severe.[1] As a result of a review of the literature of the subject and eighteen cases of his own, he concluded that the chief disadvantages of sulphonal are: 1. Its hypnotic action usually develops very slowly. 2. This action is very liable to be prolonged throughout a greater or lesser part of the following day. 3. It is difficult to determine the dose which may be given with effect and with comfort in each individual case, and this dose may vary at different times in the same case. 4. The drug is liable to produce unpleasant secondary effects, which may even replace the primary hypnotic action; chief among these are mental excitement, nausea, vomiting, dizziness, headache, languor, exhaustion, depression, and a staggering gait; these symptoms may appear after large or after quite small doses. 5. It very often fails to exert any hypnotic action, either in any dose whatever or in any amount which can be given with comfort to the patient. It sometimes produces a scarlet eruption upon the skin, as noted by Engel-

[1] *Therapeutic Gazette*, May, 1890.

mann. The rash is, in some instances, characterized by severe itching. In other cases a general pruritus has been caused without any eruption. Dr. Hugh R. Beevor advises caution in the use of sulphonal, and believes that it may exert a deleterious influence upon the composition of the blood. In several cases which have been reported, the presence of hæmatoporphyrin in the urine has seemed to depend upon the prior administration of sulphonal. When given daily for a considerable period, sulphonal slowly accumulates in the body and appears in perceptible amounts in the urine. After the drug is discontinued it completely disappears from the system in the course of two or three days.

Dr. Knaggs[1] reports a fatal result on the third day, in spite of treatment. The patient, after taking 31 Gm. (or ℥j) of sulphonal, fell into a stupor; pulse and respiration were slow, temperature a little elevated (100° to 103° F.), and there was general and complete anæsthesia. Death resulted from failure of respiration.

Dr. R. R. Pettit also reports a case of death from failure of respiration of a woman, after taking 2 Gm. (or gr. xxx). She was suffering from melancholia, with hysterical manifestations. Dr. T. H. Dillingham,[2] however, reports a case of recovery, after taking 6 Gm. (or ℥iss), in an elderly lady; the symptoms noted were stupor, with stertorous respiration, pulse slow, muscular inco-ordination, ptosis, slight facial palsy, dysuria, but no albuminuria. Patient recovered gradually in about two weeks.

Dr. Henry Waldo[3] reports a fatal case of hæmatoporphyrinuria in a male, aged 33, after ten days of acute gastric irritation and two weeks of cerebro-spinal symptoms and progressive toxic paresis following a number of daily doses of sulphonal; the writer thinks that the symptoms depend, not so much on the direct action of the drug itself, as on chemical changes, almost constantly alimentary in the first place, and probably hepatic, of which sulphonal has been the exciting cause.

Symptoms produced by acute sulphonal intoxication are nausea, vomiting, muscular tremors, rigors, paresis of the lower extremities, cutaneous eruptions, disorders of vision, and weakened respiratory movements. The urine assumes a port-wine color. After death, Stern found extensive necrosis of renal epithelium, together with minute hæmorrhages due to toxic nephritis caused by the drug. On this account extreme caution must be used in administering sulphonal when the kidneys are diseased. The reddish-brown color of the urine is due to the presence of hæmatoporphyrin, but it is uncertain whether or not this substance circulates in the blood. The presence in the urine of hemato-porphyrine is considered a fatal sign.

After poisoning, a trace of albumin and a few casts appear in the urine. Most of the sulphonal is decomposed in the body and is eliminated in the form of ethyl sulphonic acid; but a small amount of unchanged sulphonal may be found in the urine. A condition of "sulphonalism" has sometimes been noticed after prolonged administration of this drug. It manifests itself, according to Dr. Vorster, in two stages, motor depressant and sensory depressant. The latter stage is attended by danger on account of the cardiac weakness which is present. This writer, who has used sulphonal largely in

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[1] *British Medical Journal*, Oct. 25, 1890.
[2] *Medical Record*, Dec. 13, 1890.
[3] *British Medical Journal*, June 15, 1901.

the insane-asylum at Königslutter, has never witnessed any ill effects on discontinuing the remedy after its daily employment for weeks and months. In order to avoid the occurrence of chronic poisoning, Evensen suggests the advisability of alternating sulphonal from time to time with some other hypnotic remedy.

In a case of death from sulphonal Helweg found the cells of the anterior and posterior horns of the spinal column degenerated and their number diminished.

Dr. Lovell Gulland[1] has reported the case of a man, aged 39 years, of alcoholic temperament. Owing to insomnia, this patient had been in the habit of taking 2 Gm. (or gr. xxx) of sulphonal nightly. In all he had taken above 80 Gm. (or ℥ii℥ivss). A week before his death his gait was observed to be staggering and his speech was thick, but this was put down to alcoholism. When seen by Dr. Gulland for the first time he was stupid and sleepy, though easy to rouse and intelligent when spoken to. His motor power was greatly enfeebled and he could not articulate properly. The urine was deep-claret colored. He died suddenly and the post-mortem examination showed that the liver was chocolate colored, the kidneys were not cirrhotic, but congested, the spleen was diffluent, the walls of the heart were very fatty, the blood was chocolate-colored, and the brain was congested. Microscopically the liver showed no great change, but fatty infiltration at the periphery of the lobules and hyaline degeneration of the walls of the portal vein were marked. In the kidneys the secreting epithelium only was affected, the cells being shrunken into masses of granular protoplasm; the spleen was full of "shadow-corpuscles" and the suprarenal capsules showed some columns in which the cells were small and shriveled. The blood showed poikilocytosis. As regards the clinical symptoms, co-ordination may be affected for weeks by the administration of a single dose. In chronic poisoning gastro-intestinal symptoms generally first appear, nervous symptoms then appear, ataxia, paralysis of the facial muscles, general convulsions, coma, etc. The urine contains hæmatoporphyrin as well as unchanged sulphonal. The case usually ends by heart-failure. In acute cases the symptoms may come on suddenly; the sleep may be for days; hæmatoporphyrinuria seldom occurs in such cases. The prognosis, as a rule, is good in acute, but not so in chronic, cases. Sulphonal is not readily soluble, and so may remain in the intestinal canal or in the blood for a long time, as it is not easily excreted by the kidneys. The constipation which is usually present would assist in this accumulation. Sulphonal may cause death without producing hæmatoporphyrinuria. This pigment may be present in the urine also in cases of lead poisoning or in hæmorrhage from the intestine, and, according to Henry Waldo, in rheumatism, pneumonia, enteric fever, and peritonitis, the most reliable means of detecting hæmatoporphyrin in urine is by the spectroscope. The cause of death is probably due to uræmia (using the term in its widest sense). In acute cases, as the poison is slowly absorbed, the stomach should be emptied at once and a purgative given. The kidneys should be encouraged to act freely. Large enemata of warm water have been found useful. In chronic cases the same remedies may be employed as well as large doses of alkalies to render the urine alkaline and so stop the formation of hæmatoporphyrin. Any discoloration of the urine should be taken as an indication

[1] *Lancet*, Dec. 17, 1898.

to stop its use. There is some evidence that sulphonal exercises a deleterious influence upon the liver, for the relation of urea to the total nitrogen is changed and the metabolism of the purine bodies is also affected, as stated by Cushing. Sulphonal should only be administered in solution; hot milk and whisky toddy are preferred as vehicles.

Therapy.—From the preceding summary, the therapeutic applications of sulphonal may be readily inferred. It has been given successfully in nervous insomnia and in insanity. Dr. Vorster considers sulphonal peculiarly beneficial in acute mania or melancholia, promoting sleep by night and quiet by day. Sulphonal is of value in the treatment of delirium tremens and the wakefulness so common in cases of addiction to opium. Dr. William H. Flint considers it a safe and reliable hypnotic, but it is not an analgesic. It has been introduced into the British Pharmacopœia, so that it may be regarded as possessing established value as a somnifacient. Boettrich asserts that 0.50 Gm. (or gr. viiss) of sulphonal is generally successful in the prevention of night-sweats. He thinks that the effects of sulphonal equal those of atropine, and finds the former to retain its power, the sweating being decidedly less the night after a dose has been taken.[1] Jeffries[2] reports chorea much improved by the conjoined use of sulphonal and arsenic. He regards sulphonal as a valuable adjuvant to arsenic in the treatment of this disease. The paroxysm of asthma has been promptly relieved by the administration of 1 Gm. (or gr. xv) of sulphonal. Dr. J. H. Mackay, of Madison, Neb., has used sulphonal with advantage in insomnia due to influenza and alcoholism, and Dr. Julius Althaus found it beneficial in relieving the psychoses, accompanied by insomnia, which occurred as sequelæ of influenza. Dr. Edmund Andrews, of Chicago, states that the antispasmodic power of this remedy is of more value than its hypnotic influence. He has found it of great benefit in arresting the muscular spasms of fractured limbs. It is useful also in relieving the cramps of pregnant women. Sulphonal has been used with success in cases of nocturnal emissions due to spasm of the ejaculatory muscles from reflex irritation.

Dr. Julius Berenyi has reported a case of trismus neonatorum in which sulphonal was successfully employed. The remedy was administered in the dose of 0.20 Gm. (or gr. iij) in an enema and also given by the mouth. On the sixth day of treatment the paroxysms had completely disappeared. Altogether 10 Gm. (or ʒiiss) were employed without the occurrence of somnolence or disagreeable after-effects.

It serves a useful purpose in quieting the irritability due to teething, preventing convulsions and producing peaceful sleep. Sulphonal is beneficial in epilepsy. This remedy alleviates obstinate hiccough and has been recommended as a preventive of seasickness. The late Dr. A. J. C. Skene successfully employed sulphonal as an hypnotic after laparotomies, and it may be given with the same object after other surgical operations, provided that severe pain is not present.

Casarelli has made use of sulphonal in the treatment of diabetes mellitus, upon which he observed this drug to have a favorable influence, gradually lessening the quantity of sugar. The amelioration is evident after the remedy has been used for several days in doses of 1 to 2 Gm. (or gr. xv-xxx) *per diem*.

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[1] *Therap. Monatshefte*, March, 1890; *American Practitioner and News*, Jan. 31, 1891.

[2] *Weekly Medical Review.*

In the dose of 3 Gm. (or gr. xlv), long continued, it produced a condition of lethargy and sometimes delirium. But if intermitted for a day, or if the dose be diminished, these manifestations cease. If the drug be abandoned the sugar soon reappears.[1]

SULPHONETHYLMETHANUM (U. S. P.).—**Sulphonethylmethane.**

Dose, 1 to 2 Gm. (or gr. xv-xxx).

Pharmacology.—"Diethyl-sulphon-methyl-ethyl-methane is a product of the oxidation of the mercaptol obtained by the condensation of methyl-ethylketone with ethylmercaptan." It is known under the trade name of trional. Tetronal and trional are allied to sulphonal, having the same general formula, except that, whereas sulphonal contains only two ethyl groups, trional and tetronal contain three and four, respectively.

Trional occurs as brilliant tablets, tetronal as brilliant tablets and scales. Both substances have a bitter taste, that of tetronal being, at the same time, camphoraceous. Trional is devoid of odor, is readily soluble in alcohol and ether, sparingly soluble in cold water, and is best administered in warm water, milk, soup, or tea. Trional melts at 76° C. (168.8° F.). Tetronal dissolves in alcohol and ether, but is less soluble in water than trional.

Baumann and Kast have published the results of a number of physiological experiments with compounds allied to sulphonal, from which they drew the conclusion that the hypnotic action of this class is a function of the ethyl groups in the compound, and proportionate in intensity to their number, and that the SO_2 group exercises no influence in this direction. These results were so suggestive that Barth and Rumpel repeated the experiments clinically and on the human subject. The results obtained corresponded to the observations made upon dogs only so far as to demonstrate that tetronal and trional actually possessed hypnotic properties, but they did not confirm the theory, since practically the same doses were required in order to produce the same effects as those of sulphonal, instead of one-half to two-thirds, as might have been expected. These agents might be useful in cases where sulphonal cannot be taken. No injurious effects were observed in any of the two hundred and twenty cases in which trional and tetronal were administered.[2]

The use of trional, even when continued for a considerable period, has seldom been productive of evil consequences, or established a habit. Its disuse, moreover, has not been followed by any manifestations, except, possibly, the return of the insomnia for which it was originally given. It has little or no influence upon the action of the heart. Schultze has, however, reported[3] a case in which trional had been given every night for four or five weeks. The patient was a woman afflicted with melancholia and sleeplessness. Toward the end of the period named her condition, without apparent cause, became aggravated, the urine assumed a dark-red, almost black, color, which was demonstrated to be due to the presence of hæmatoporphyrin. Dr. Stuart Hart[4] refers to certain rare and important sequelæ following the use

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[1] *Annales de Thérapeutique Medico-Chirurgicale*, Sept., 1890.

[2] *Pharmaceutical Journal and Transactions*, Aug. 30, 1890, and *Therapeutic Gazette*, Oct. 15, 1890, p. 700.

[3] *Deutsche medicinische Wochenschrift*, Feb. 15, 1894.

[4] *American Journal of the Medical Sciences*, April, 1901.

of trional in doses of 1 Gm. (or gr. xv) every alternate day for two months. The patient, a woman, aged 50 years, at this time was seized with sudden gastro-intestinal irritation, followed by hæmatoporphyrinuria and cardiac disturbances; a few casts and some albumin were found in the urine. The nerve-disturbance took the form of a peripheral neuritis leading to foot- and wrist- drop on left and right sides; cerebral toxæmia—viz., periods of delirum, mental confusion, and hallucinations of time and space—was also noted. The patient lost flesh and had slight œdema of the ankles and considerable physical weakness. Recovery followed in about twelve months. It is, therefore, advisable that, in every case where trional is continuously given, the urine should be carefully watched. From experiments upon animals, Dr. Otto Bakofen determined that trional is toxic only in massive doses given continuously, or with short interruptions. In his investigations he never found any changes in the kidneys or observed hæmatoporphyrinuria. Both tetronal and trional have a slight cumulative action. When excessive doses have been taken as a result of accident or from suicidal intent, the stomach should be emptied, or, if free absorption has taken place, elimination should be hastened by the use of diuretics, and stimulants should be administered. Copious enemata of warm water are useful. In chronic poisoning by sulphonal or trional, it is only necessary to withdraw the drug, and to give restoratives.

Therapy.—In delirium tremens, tetronal is less efficient than sulphonal; but, as an hypnotic, tetronal was found, in 14 cases out of 30, superior to the latter drug, in 6 cases equal, and in only 4 inferior. Trional in 17 cases was superior, in 6 cases equal, and in 7 inferior. Barth and Rumpel conclude that the indications for the use of these compounds correspond with those of sulphonal, and in certain nervous conditions which are refractory to this drug the others may prove more effective, or, at least, are useful substitutes. Dr. J. B. Mattison, of Brooklyn, has found trional of advantage in the treatment of the opium, chloral, or cocaine habit, and regards it as the most powerful hypnotic at present at our command. In accord with other observers, he has failed to find it useful as an anodyne, but states that in painful conditions a combination with codeine or phenacetin will often produce an excellent result.

Dr. William Mabon, of the State Hospital at Utica, N. Y., concludes that both tetronal and trional possess decided hypnotic and sedative power. Trional appeared to be of superior value as an hypnotic for the insane, but tetronal seemed to give the best results as a sedative. The efficacy of trional is principally displayed in simple insomnia occurring in functional or organic nervous diseases. Trional caused sleep in most cases of alienation accompanied by moderate or severe excitement, but was without effect upon the mental condition. In some insane epileptics, though trional was without effect upon the frequency or severity of the paroxysms, it shortened the post-epileptic delirium. According to some writers, trional is contra-indicated in melancholia, hypochondria, or whenever mental depression is present. Trional given by the rectum in a somewhat increased dose has likewise proved efficient. Koppers states that a dose of 0.25 to 0.50 Gm. (or gr. iv-viij) of trional is of value in restraining night-sweats. Sulphonal and trional have the same therapeutic action, except that trional is a little stronger. They are safer than chloral hydrate, or any remedy containing the element chlorine, especially in cases of fatty degeneration of the heart.

SULPHUR.—Sulphur, Brimstone.

Forms and Preparations.

Sulphur Lotum (U. S. P.).—Washed Sulphur (sublimed sulphur thoroughly washed with water). Dose, 2 to 15.5 Gm. (or 3ss-℥ss).

Sulphur Sublimatum (U. S. P., B. P.).—Sublimed Sulphur, Flowers of Sulphur. Dose, 1.30 to 4 Gm. (or gr. xx-3j).

Sulphur Præcipitatum (U. S. P., B. P.).—Precipitated Sulphur (sublimed sulphur treated with lime, hydrochloric acid, and boiling water). The preferred form for internal administration. Dose, 2 to 8 Gm. (or gr. xxx-3ij).

Sulphuris Iodidum (U. S. P., B. P.).—Sulphur Iodide. (Iodine, 80 per cent.) Dose, 0.03 to 0.25 Gm. (or gr. ss-iv).

Unguentum Sulphuris (U. S. P., B. P.).—Sulphur Ointment (washed sulphur, 15, benzoinated lard, 85 parts; U. S. P.; sublimed sulphur, 1; benzoinated lard, 4 Gm., B. P.).

Pulvis Glycyrrhizæ Compositus (U. S. P., B. P.).—Compound Powder of Glycyrrhiza (contains washed sulphur, 8 per cent.; B. P., sublimed sulphur). Dose, 4 to 8 Gm. (or 3i-ij).

Unguentum Sulphuris Iodidi (B. P.).—Sulphur-Iodide Ointment (sulphur iodide, 2 Gm.; glycerin, 2 Gm.; benzoinated lard, 46 Gm.).

Trochiscus Sulphuris (B. P.).—Sulphur Lozenge (each lozenge contains 0.32 Gm., or gr. v, of precipitated sulphur).

Confectio Sulphuris (B. P.).—Confection of Sulphur (sublimed sulphur, 100 Gm.; acid potassium tartrate, 25 Gm.; tragacanth, 1 Gm.; syrup, 50 c.cm.; tincture of orange, 12.5 c.cm.; glycerin, 37.5 c.cm.). Dose, 4 to 8 Gm. (or 3i-ij).

The sulphite, thiosulphate, and phenolsulphonate of sodium are official, the bisulphite in the U. S. P. only. (See Sodium.)

Pharmacology.—Sulphur is a non-metallic, solid element, found native in Sicily and Iceland in the neighborhood of extinct volcanoes; it is widely distributed in combination with metallic bases as sulphides, especially of iron, copper, lead, mercury, etc. It is of a lemon-yellow color, tasteless, odorless, and brittle. At a temperature of 111.5° C. it melts into a brownish-yellow, transparent liquid, which crystallizes on cooling. It is dimorphous, having two distinct forms of crystals. Sulphur is insoluble in water, but very slightly soluble in alcohol, ether, and benzene; its best solvent is carbon disulphide. It is likewise soluble in the oil of turpentine and in alkaline fluids. It has powerful chemical affinities, and in combination with oxygen forms sulphurous and sulphuric acids, which, with bases, form sulphites and sulphates. Sulphur is an important constituent in certain native mineral springs, which furnish sulphureted waters. In this place the action of sulphur need alone be considered. The sublimed sulphur contains a trace of free acid, which makes it slightly irritating, and, when taken into the intestines, it occasionally causes griping. Owing to its insolubility in water, sulphur, either washed or precipitated, has no effect upon the skin, although when kept in contact with it for some time it may be partially oxidized, forming sulphurous acid, which is an energetic disinfectant. In the alimentary canal, the pure sulphur acts as a laxative, partly as a result of chemical change (since hydrogen-sulphide gas is formed in considerable quantity, and sulphur compounds are found in the blood) and partly mechanically as a dry powder. By the interaction of hydrochloric and hyposulphurous acids Engel has lately succeeded in producing two new allotropic forms of sulphur. One of these appears as orange-yellow crystals of the rhombohedral type which differ absolutely from any other form of sulphur hitherto known. The second occurs as yellow flakes entirely soluble in water. The solution decomposes rapidly, giving rise to the ordinary amorphous sulphur.

The recognized sulphides are Calx Sulphurata (U. S. P., B. P.), commonly misnamed sulphide of calcium (consisting chiefly of calcium monosulphide and calcium sulphate, in varying proportions); Antimonii Sulphidum; Antimonium Nigrum Purificatum (B. P.); Antimonium Sulphuratum (B. P.); and Potassa Sulphurata (B. P.).

Oil of Sulphur is the popular name of a preparation made by boiling olive-oil, 8 parts, and 1 part of sublimed sulphur together in an iron pot until a uniform mixture is obtained; according to the old Edinburgh Pharmacopœia, it was also known as balsam of sulphur. The oil is partly decomposed, and the resulting preparation has an extremely fetid odor and acrid taste. The German Pharmacopœia has a similar preparation, made with linseed- instead of olive- oil.[1]

Spirit of Sulphur, or liquor fumans (Boyle), is the name applied to a preparation resulting from adding washed sulphur, 1 part, to concentrated ammonia, 6 to 8 parts, and passing hydrogen sulphide through the mixture until the sulphur is dissolved.[2]

Ichthyol contains a large proportion of sulphur.

Washed and precipitated sulphur should contain not less than 99.5 per cent., and sublimed sulphur not less than 99 per cent. of pure sulphur (U. S. P.). Sulphur is a constituent of the volatile oils of mustard, garlic, and asafetida. It also enters into albumin and other proteid substances. It constitutes a large part of certain bacteria and algæ. At least six crystallizable modifications of sulphur are known, and one amorphous. The latter is insoluble in carbon disulphide, but the crystals are soluble. Both are insoluble in water. The fumes of burning sulphur were formerly used as an antiseptic for disinfection; but this is now accomplished better with formaldehyde.

Physiological Action.—The fact that sulphur enters the blood from the small intestine is shown by its chemical effects upon silver coins or jewelry worn by persons while taking it; secondly, by the physiological effects, its appearance in many secretions; and, thirdly, its therapeutic results as an alterative. The intestinal secretions are moderately increased by it, as well as the peristaltic movements, and the stools are rendered softer. It is believed to exert a stimulant effect upon the mucous membrane and skin, and strong applications in the form of an ointment bring out an eruption of an eczematous character. Erythema, papules, or pustules are also, in some cases, produced either by the external or internal use of this substance. Sulphur is excreted principally by the bowels, but also by the skin, the perspiratory and the milk glands, and by the urine; in the latter it usually appears as a sulphate, in the others it is in the form of hydrogen sulphide. Sulphur plays an important part in the normal physiological processes of the body, being a constant constituent of albumin, and present in nearly all the solids and fluids of the body. From this fact and others, we are led to believe that sulphur is essential to the health of albuminous organs and tissues, and is an important element in nutrition. The antiseptic and germicidal effect of sulphur may exercise an important prophylactic influence in preventing, under ordinary circumstances, the invasion of the tissues by micro-organisms. A number of observations have been published relative to the absorption of hydrogen-sulphide gas by the intestinal mucous membrane and its passage into the blood, to be carried to the lungs, where it escapes from the bronchial mucous membrane and acts as a local disinfectant. This gives a hint of the unsuspected rôle, played by sulphur, of a pulmonary disinfectant and expectorant, in addition to the property,

[1] *Druggists' Circular*, Jan., 1891.
[2] *Druggists' Circular*, Jan., 1891.

for which it is already valued, of an intestinal disinfectant. It probably, after absorption, favors the bile-producing function of the liver, since taurocholic acid normally contains a large proportion of sulphur. Upon the circulation, no direct effect is noticed, but it is believed that it increases the heart's vigor, as it does that of muscular tissue in the arteries and in the various hollow viscera, as well as the voluntary muscles.[1]

Therapy.—Sulphur is used in a very large number of diseases externally, and often with marked curative action. In acute infectious disorders (diphtheria or scarlatina, for instance), the flowers of sulphur may be insufflated into the throat or nose with marked benefit, limiting the spread of the disease, destroying the micro-organisms, and preventing blood-poisoning. In scarlatina, erysipelas, measles, and small-pox, an ointment containing sulphur moderates the heat of the skin, allays congestion or inflammation, and disinfects the pustules of variola. Dr. Iscar advocates the use of sulphur internally in variola and gives to children 0.13 Gm. (or gr. ij) every hour in a mixture of glycerin, orange-water, and syrup. Mr. J. B. Josset has employed sulphur-baths in the treatment of whooping-cough for fifteen years with favorable results. The proper quantities for children are: From 3 to 12 months, $^1/_2$ ounce of potassium sulphide to 10 quarts of water (15.5 Gm. to 9 $^1/_2$ litres); from 1 to 2 years, $^3/_4$ ounce to 15 quarts (23.3 Gm. to 14 litres); from 2 to 4 years, 1 ounce to 24 quarts (31 Gm. to 22 $^1/_2$ litres); from 4 to 6 years, 11 drachms to 30 quarts (42.5 Gm. to 28 litres); from 6 to 8 years, 14 drachms to 38 quarts (54 Gm. to 35 $^1/_2$ litres); from 8 to 10 years, 2 ounces and 3j to 45 quarts (66 Gm. to 42 litres). The temperature of the bath should range from 96.4° to 97.8° (F.), and its duration should be from 25 to 45 minutes. The patients take one bath daily, and after the bath they are wrapped up in hot towels and woolen blankets. Recovery usually takes place in two weeks. In addition, an antimonial and sedative cough-syrup is used to quiet the paroxysm. The use of baths containing potassium sulphide, or a resort to a sulphur spring, are also of great value in syphilis. In very many integumentary inflammations, especially chronic eczema and psoriasis, sulphur alone, or combined with other drugs, will lessen the congestion and overcome the infiltration of the parts. It is often employed with advantage in chronic acne and rosacea, but great care should be exercised in applying it upon the face, especially if the sebaceous glands are in a patulous condition. If brought in contact with the skin under the latter circumstances, the glands often become filled with sulphur and occasion many black points (acne punctata) upon the skin. The following formulæ are useful in acne, especially of the face:—

℞ Sulphuris loti. . . . . 4| Gm. or 3j.
Glycerini . . . . . 7|5 c.cm. or f3ij.
Aquæ rosæ . . . . . q. s. ad 30| c.cm. or f3j.

M. Sig.: Apply with a soft sponge at night, after evacuation of pustules and the local use of hot water.

℞ Sulphuris sublimati,
Pulv. marantæ,
Salolis . . . . . aa 4| Gm. or 3j.
Ungt. zinci oxidi . . . . . 31| Gm. or ℥j.

M. Sig.: For acne; apply once or twice daily.

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[1] See paper by author on "The Physiological and Therapeutical Action of Sulphur," "Transactions of the Pennsylvania State Medical Society," 1890.

In alopecia, especially the circumscribed variety, sulphur often acts well in assisting to restore the growth of the hair. In very many diseases of the skin, especially those of a parasitic nature, this agent can be used more effectively in the form of a sulphur-vapor bath. Sulphur is very largely employed as an external remedy in scabies, but it is also excellent for pediculosis, tinea capitis, barbæ and corporis, and tinea versicolor. As a germicide, its effects are most evident when combined with oxygen, as sulphurous-acid gas. In treating scabies, no permanent result should be expected, unless measures are taken to prevent reinfection by the parasite. The underclothing must be destroyed, or, at least, exposed to an elevated temperature for several hours, and thoroughly washed with soap and boiling water. The patient should take a warm bath, rubbing the interdigital spaces and flexures of affected points thoroughly with potash or soft soap. After the bath the following ointment may be rather freely applied to the affected spots, or where itching is experienced, and allowed to remain until morning, when it may be wiped off:—

℞ Ol. cadini	4	c.cm. or f3j.
Ungt. sulphuris	8	Gm. or 3ij.
Adipis lanæ	19|5	Gm. or 3v.

M. Sig.: Apply at night, as directed.

A repetition of this treatment, once or twice, may effectually relieve the patient of his parasites. When the sulphur ointment is used it sometimes causes an eczematous eruption, which may be avoided by diluting the preparation. In pediculosis of the body, a similar treatment to the above is generally effective, providing the clothing be changed at the same time. In either of the preceding cases the cure is not to be attributed to the direct parasiticide effect of sulphur, but is owed to the fact that it makes a dense and tenacious substance with lard, which suffocates the itch-insect. Indeed, the late Professor Leidy was of the opinion that the sulphur is unnecessary, as the oil would block up the air-pores of the acarus just as well without it.

Mr. W. Arbuthnot Lane writes that he employs sulphur with decided advantage as a surgical dressing in tuberculosis of joints and bones and also in other infectious processes. The action is rendered more uniform and less violent by mixing it with glycerin. This emulsion is allowed to remain in the cavity for twenty-four hours, after which the seat of disease is irrigated every day by a weak corrosive-sublimate solution or the sterile normal saline solution. The same method is efficacious in the foul impetiginous ulcers of children. Finely-powdered sulphur is dusted upon a piece of gauze which is applied to the ulcerated surface for an hour or two, after which the lesion begins to heal rapidly; in some cases several applications may be necessary. He has, moreover, found sulphur beneficial in the foul ulcerative stomatitis so common in the children of the poor.

In sciatica, H. G. de Mussy envelops the limb in a cloth containing a thick paste of the flowers of sulphur. One night is sufficient to relieve the patient. The urine acquires a very strong odor of hydrogen sulphide. L. Duchesne also reports success with this in a case of several years' standing.[1] Friction with sulphur affords relief in obstinate cases of chronic rheumatism.

Internally, sulphur is used as a simple laxative, especially combined

[1] "Annual of the Universal Medical Sciences," 1890, vol. v, page A-144.

with potassium bitartrate, in affections of the lower bowel, irritable piles, stricture, fissure, or fistula. By relieving engorgement of the hæmorrhoidal vessels, sulphur proves useful in cases of bleeding from piles. After operations upon the pelvic organs it is the best laxative to administer. The dose ordinarily need not be more than 0.32 to 0.65 Gm. (or gr. v-x) daily in order to insure a free evacuation of the bowels, and if it is continued for some time we obtain valuable systemic effects. In chronic sore throat, associated with or springing from indigestion, these small doses of sulphur, with some attention to hygiene, will effect a cure. In digestive difficulties due to disordered action of the liver, which ultimately lead to lithæmia and structural lesions, the habits of life must first be corrected, and the hepatic torpor will then be overcome by small doses of sulphur. Dr. Garrod has reported remarkable relief from obstinate hepatic colic by the daily use of a 0.32 Gm. (or gr. v) sulphur lozenge, persisted in for months. In hepatic disorder attended by constipation, it may be well to administer a mercurial purge to initiate the treatment, before giving the tonic doses of sulphur. Dr. Schulz recommends the use of sulphur in certain cases of chlorosis. When iron is inefficient or cannot be tolerated the general condition is decidedly improved by sulphur, and after this remedy has been used for some time the iron can be resumed with success. He regards it as of no avail when chlorosis is complicated with catarrhal and inflammatory conditions of the digestive tract. The remedy should be given in small doses.

Minute amounts of sulphur sometimes do good in diarrhœa, especially in cases of offensive watery stools of scrofulous children and in dysenteric diarrhœa. As sulphur stimulates mucous membranes, it is useful in chronic bronchitis, as Graves long ago pointed out in his clinical lectures. For this purpose sulphureted mineral waters and the springs from which they flow are justly celebrated.

This remedy is especially suitable to the chronic bronchitis, accompanied with copious secretion, of aged and debilitated persons. In whooping-cough, small doses of sulphur lessen the paroxysms; and the following formula, as modified from Sée, may be administered:—

℞ Sulphuris præcip.	3|25	Gm. or gr. l.
Ext. belladonnæ folior.	|065	Gm. or gr. j.
Pulv. ipecacuanhæ et opii	|32	Gm. or gr. v.
Sacchari albi	1|30	Gm. or gr. xx.

M. et ft. capsulæ vel chartulæ no. x.

Sig.: From two to ten capsules or powders a day, according to the age of patient and effect produced.

Garrod suggests that sulphur may be of service in cystitis, and, perhaps, in some disorders of the kidney. It might very properly be tried in tubercular or gouty pyelitis, and likewise in disordered menstruation, when largely or entirely functional in character. In muscular pains, attending lithæmia, gout, and rheumatism, Garrod employed small doses of sulphur in conjunction with iodine or arsenic, and he reported great improvement from this treatment, even in rheumatoid arthritis. This remedy is also of avail in those cases of neuralgia dependent upon the rheumatic diathesis. Sulphur has not, hitherto, given very positive results in tuberculosis. Arbuthnot Lane has given it as an intestinal disinfectant in anthracæmia. The continued administration of fractional doses of sulphur is often beneficial in seborrhœa, sycosis, chronic eczema, psoriasis, and other cutaneous diseases, especially

when the upper layer of the skin and the glands are involved. In alopecia, small doses of sulphur will often increase the activity of the hair-forming apparatus, and may also assist in restoring the hair to the parts. In diseases of the nails, especially when they become brittle, covered with ridges and white spots, the continued use of small doses of sulphur will frequently bring about a healthy and polished appearance of these useful appendages. For internal administration, calx sulphurata is preferred to sulphur, on account of its greater solubility. It is of special value in acne, given as a pill, 0.03 Gm. (or gr. $^1/_2$), several times a day. So-called volatile spirit of sulphur was formerly believed to be a panacea in syphilis, rheumatism, diabetes, and consumption, in doses of 0.18 to 0.24 c.cm. (or *m*iii-iv), well diluted. It is merely a solution of ammonium sulphide, and might be given in larger doses without doing either much harm or good to the patient.

Sulphur has been highly esteemed as a fumigating agent for rooms which have been occupied by patients suffering from contagious disorders. Doubts have been thrown upon its value as a disinfectant by the experiments of Koch and Sternberg. These, however, related to the power of the gas in disinfecting apartments and large masses of material. The gas was rapidly lost by diffusion and was found to have slight influence upon dry spores. The investigations of Thoinot demonstrate that, while the anthrax bacillus is resistant to the action of sulphur, the organisms of tuberculosis, glanders, typhoid fever, cholera, and diphtheria are destroyed by the fumigations. Associated with live steam, the fumes of burning sulphur are used with marked advantage in disinfecting ships at quarantine and infected rooms. The fact that plague is conveyed by rats has led to the introduction of the following method of destroying them in ships: Sulphur-dioxide gas is generated in a chamber in which sulphur is spread on a wire netting in the proportion of 1 pound to every 250 cubic feet required. The sulphur is ignited with the help of alcohol and the gas is pumped into the bottom of the space to be treated. A pipe from the top of the space brings air back to the generator. The oxygen in the treated space—for instance, the hold of a vessel—is thus gradually replaced by SO_2. This gas, being much heavier than air, diffuses slowly, and the rats retire before it. When the hold is opened they are found dead at the highest parts: those nearest the exit pipe. This is important, because otherwise rats may die behind partitions. The only drawback of this method is the tarnishing of gilding.[1]

Thiuret.—This name is given to an oxidation product of phenyldithiobiuret, and occurs as a crystalline, odorless powder, insoluble in water, but freely soluble in alcohol and ether. When mixed with alkalies, sulphur is disengaged in the nascent state. On this account thiuret is possessed of energetic antiseptic properties.

SUMBUL (U. S. P.), SUMBUL RADIX (B. P.).—Sumbul-root.

Preparations.

Extractum Sumbul (U. S. P.).—Extract of Sumbul. Dose, 0.30 to 1 Gm. (or gr. v-xv).

Fluidextractum Sumbul (U. S. P.).—Fluid Extract of Sumbul. Dose, 1 to 4 c.cm. (or *m*xv-f3j).

Tinctura Sumbul (B. P.).—Tincture of Sumbul (10 per cent.). Dose, 2 to 4 c.cm. (or f3ss-j).

[1] *Journal of the American Medical Association*, May 18, 1901.

Pharmacology.—Sumbul is the dried rhizome and roots of an unknown plant of the family Umbelliferæ, growing in Asia. In commerce the root is in dried, transverse slices, has a decided odor, resembling musk, and a somewhat bitter, balsamic taste. It contains two acids, **angelic** and **valerianic**, two balsamic resins, a volatile oil, bitter extractive, etc.

Physiological Action.—In its effect upon the nervous system sumbul resembles valerian, and is an efficient nerve-tonic. In small doses it stimulates the appetite and facilitates digestion.

Therapy.—Sumbul is of value in hysteria and neurasthenia, in anæmic women. For such cases Goodell prescribed:—

℞ Ext. sumbul,
Ferri sulphatis exsiccat. ..... aa 1 | 30 Gm. or gr. xx.
Pulv. asafœtidæ ..... | 65 Gm. or gr. x.
Arsenii trioxidi ..... | 03 Gm. or gr. ss.
M. et ft. pilulæ no. xx.
Sig.: Take one, thrice daily, after meals.

Sumbul is useful, moreover, in the treatment of neuralgia, functional irregularity of the heart, restlessness, the insomnia of chronic alcoholism, and nervous dyspepsia. As most of these disorders are associated with impaired nutrition and sluggish movement of the bowels the author has, in many instances, associated it with nervine and laxative remedies, as in the following combination:—

℞ Extracti sumbul,
Pulv. asafœtidæ ..... aa | 065 Gm. or gr. j.
Ext. rhamni pursh. ..... | 03 Gm. or gr. ss.
Aloin. ..... | 006 Gm. or gr. $^1/_{10}$.
Ext. nucis vom. ..... | 008 Gm. or gr. $^1/_8$.
Oleoresinæ zingiberis ..... | 015 c.cm. or *m* $^1/_4$.
M. et ft. pil. no. j. Mitte no. xxiv.
Sig.: One or two pills to be given at a dose.

This preparation promotes the action of the liver and bowels, improves nutrition, allays irregular nervous manifestations, and is beneficial in depressed or excitable conditions of the nervous system.[1]

The tincture may be given in hysteria, chronic bronchitis with spasmodic cough, also in delirium tremens, as a substitute for musk. By Russian practitioners, sumbul is esteemed a valuable stimulant in typhoid fever, atonic dyspepsia, asthenic diarrhœa, and dysentery. Dr. Granville, who introduced this remedy into England, recommended it in epilepsy and dysmenorrhœa. Phillips testifies to its decided efficacy in facial, sciatic, or ovarian neuralgia occurring in women of a quick and lively nervous temperament. He has seen it useful, also, in certain stages of phthisis, in the restlessness of pregnancy, and the insomnia of chronic alcoholism. It is essential that a fresh specimen, in good condition, should be employed in making the tincture, in order to get any results.

SYMPHYTUM.—**Comfrey.** The Symphytum officinale (Boraginaceæ), a small herb of Europe and the United States, has a root possessing some medical properties. It contains some **Asparagin**, a large amount of mucilage, and traces of tannin. It is used in decoction.

[1] *Medical Bulletin*, May, 1893, p. 172.

Physiological Action. — The asparagin has little, if any, physiological effects beyond slight diuretic action; but the mucilage makes it demulcent and slightly astringent. The pulp of the root has been utilized as a means of stiffening bandages applied to fractures.

Therapy.—The fresh root, bruised and cut, is applied to wounds, bruises, cracked nipples, etc. Internally the decoction is given in diarrhœa, dysentery, pulmonary affections, and other relaxed conditions of mucous membranes. It is utilized for the purposes to which marshmallow is ordinarily applied, in domestic cough-mixtures, etc.

SYRUPUS TOLUTANUS (U. S. P., B. P.).—**Syrup of Tolu.**

Dose, 4 to 16 c.cm. (or ʒi-iv).

An agreeable addition to, or vehicle for, cough remedies.

SYZYGIUM JAMBOLANUM. (See **Jambol.**)

TABACUM.—Tobacco.

Pharmacology.—"The commercial, dried leaves of Nicotiana Tabacum" (Solanaceæ), indigenous to the southern portions of this country and cultivated in different parts of the world, are no longer official, and have no official preparations. Carried to Europe by the Spaniards, it was taken to France, in 1560, by the French ambassador, whose name, Nicot, is preserved in the generic title applied to the plant. Its active principle is a liquid alkaloid, **Nicotine**, the poisonous principle, which was discovered in 1828, by Posselt and Reimann. The fumes, when burning, contain **pyridine**, hydrocarbons of the aromatic series, small amounts of creosote, hydrocyanic and acetic acids, sulphur and carbon compounds, and certain gases, but little, if any, nicotine, which is decomposed by heat (Zeise). The existence of **Nicotianin**, a camphoraceous substance, has been affirmed by Hermbstädt, which is held to be chiefly responsible for the flavor or aroma of the tobacco, as it occurs only in dried leaves. Flückiger found about 10 per cent. of potassium nitrate, chiefly in the stems and veins. Potassium malate is also present. Slight differences in composition exist in specimens grown in different places, as it is well known that the variation in flavor and quality is very decided. The best tobacco is grown in Cuba and Virginia. The Turkish variety is almost free from nicotine, and is very mild. In the East, the tobacco is sometimes tinctured with opium, in order to increase the narcotic effect. The percentage of nicotine varies in different tobaccos (generally 2 to 8 per cent.).

Physiological Action.—Tobacco is a nacro-narcotic poison, acting, as is well known, in small doses, upon persons unaccustomed to its use. It is a nauseating emetic, its action being accompanied by great muscular relaxation; the respiration and circulation are depressed, the temperature lowered, and the surface becomes cold and moistened with perspiration. It is a stimulant to the salivary and intestinal secretions, increases the peristaltic movements of the bowel and the flow of urine and perspiration. From experiments upon seven healthy persons unaccustomed to smoking, Dr. J. Ydan-Pouchkine found that tobacco diminishes the quantity of free hydrochloric acid in the gastric juice as well as the digestive power of the fluid, retards the action of pepsin, increases the movements and absorbent power of the stomach. It is without influence upon the acidity of the urine. The muscles, which at first are relaxed, may be seized later by tremor or clonic spasms,

or even tonic contractions, followed by paresis of a transitory character. The nervous system is early affected by the drug. The motor nerves are paralyzed progressively from the periphery to the central organs; there are no marked effects upon the sensory nerves. Tobacco increases the excitability of the heart by a direct action upon its intrinsic ganglia. The spinal and cerebral centres become affected, and inco-ordination, a staggering gait, and vertigo are prominent symptoms of the toxic action. Finally, collapse and death may occur from paralysis of the heart or of the respiration. Similar results also follow the inhalation of tobacco-smoke, though generally they appear in a much milder form than when the drug is swallowed. Poisoning has also followed the application of tobacco-leaves to a wound, in the case of a child twelve years of age. **Nicotine** is a most active poison, resembling hydrocyanic acid in the rapidity of its fatal effects. Eight drops will kill a horse; two drops will kill a dog. It affects both the heart and the blood-vessels, and may produce coronary spasm and angina pectoris. This is especially the case in old smokers (Peter). Nicotine retards the absorption of oxygen by the hæmoglobin, and hinders hæmatapoiesis. The nervous and arthritic are said to be more susceptible to the toxic effects. In a small dose tobacco stimulates the spinal cord, bulb, and pneumogastric, but large doses paralyze the vagus. Georges Petit considers that its action renders the organism more susceptible to infection, and especially to tuberculosis. The use of tobacco in the form of snuff, or by chewing or smoking, is almost universal, and extends to uncivilized and civilized alike, and is especially prevalent among the robust and those who lead an active life. Occasionally, from smoking an unusually strong cigar, or too many of them, there is nausea and vertigo, even in practiced smokers. In such cases, a stimulant, such as aromatic spirit of ammonia or compound spirit of ether, promptly alleviates the distress.

According to the records of the senior classes of Yale College for a period of eight years, however, those who used no tobacco were 20 per cent. taller than the smokers, 25 per cent. heavier, and had 66 per cent. more lung capacity.

Poisoning and Antidotes.—In cases of acute poisoning and collapse, cardio-vascular stimulants may be given hypodermically, and the patient kept quiet and warm. Mustard-leaves may be applied to the chest and other parts of the body, and artificial respiration practiced, if needed. Stimulating enemata, containing alcohol or turpentine, may be useful; and, if there is much vomiting, brandy and ice may be given in small quantities. Tannic acid and iodides are chemically incompatible, and camphor is a physiological antidote. Nasturtium officinale is claimed to be the antidote par excellence.[1] In what might be called chronic tobacco-poisoning, we have various inflammations of the mouth; epithelial cancer of the lip or tongue; follicular pharyngitis; bronchial catarrh; rapid, weak, and irregular action of the heart, which may become hypertrophied; dyspepsia and weakness of sight, due to restriction of the field of vision (scotoma), which may progress to total blindness. Color-blindness has been attributed to the excessive use of strong tobacco. Muscular weakness and tremors and reduced capacity for physical and mental exercise are common symptoms of an abuse of tobacco. Probably the need of something to restore the nervous system after using

[1] *Lancet*, Dec. 30, 1905; p. 1914.

tobacco is one explanation of the frequent resort to alcoholic stimulants by users of the weed. The habit of excessive indulgence is especially injurious when the fumes are inhaled, as in cigarette-smoking, as by this means the poisonous products are brought directly into the air-cells, and are absorbed by the blood. In all such cases the treatment must begin by reduction, or complete cessation, of the habit of smoking, and the administration of strychnine sulphate in small doses, with open-air exercise. If there is much overaction of the heart, it can be steadied by small doses of opium, in addition to digitalis or strophanthus.

Therapy.—Tobacco is rarely used medicinally, its good effects as a cathartic not being of sufficient value to counteract its depressing action upon the heart and respiration, to which some persons are especially liable to suffer. The only practical application is to afford an excuse for the prescription of an Havana after a good dinner, as an aid to digestion. Tobacco may be mixed with stramonium or belladonna, and the smoke inhaled, with relief in asthma.

Pulverized tobacco, or snuff, is said to be efficacious in breaking up stubborn paroxysms of hiccough, a pinch being drawn into the nostrils by a strong inspiration. Tobacco should not be administered internally for strychnine poisoning, nor in tetanus, nor used per enema.

Eudermol, or nicotine salicylate, has been applied in the form of ointment (1 per cent.) in the treatment of scabies, by Wolters.[1] He used it in 63 cases and in no case were more than six applications required. It has been said to have the advantage over other remedies, usually employed, of being free from odor and not staining the linen.

Previous to the introduction of chloroform and ether, tobacco was occasionally employed in order to produce muscular relaxation in strangulated hernia, after fracture of the femur, etc. Every purpose for which tobacco was formerly used is now accomplished more efficiently and safely by anæsthetics and other agents.

TALCUM (U. S. P.).—**Talc (Soapstone).**

TALCUM PURIFICATUM (U. S. P.).—**Purified Talc.**

Talc is a native hydrous magnesium silicate (U. S. P.). The purified talc is used as a dusting powder in erythema, prickly heat, and other pruritic skin affections.

TAMARINDUS (U. S. P., B. P.).—**Tamarinds.**

Preparation.

Confectio Sennæ (U. S. P., B. P.).—Confection of Senna (contains tamarinds, 10 per cent., U. S. P.; 12 per cent., B. P.). Dose, 4 to 8 Gm. (or 3i-ij).

Pharmacology and Therapy.—The preserved pulp of the fruit of Tamarindus Indica (Leguminosæ), freed from the brittle outer part and preserved with sugar. It is only used in medicine for the purpose of making a refrigerant and somewhat laxative infusion, and also as an ingredient in the confection of senna. A tamarind whey, which may be used as a refrigerant in fevers, is made by infusing an ounce of the pulp in a little boiling water, and adding this to a quart of milk.

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[1] *Therapeutische Monatshefte*, Aug., 1898.

TANACETUM.—Tansy.

Pharmacology. — The leaves and tops of Tanacetum vulgare (Compositæ), or common tansy, contain a bitter principle, **Tanacetin,** a volatile oil, tannic acid, etc. The oil contains borneol camphor, terpene, thujone, and thujyl alcohol. The dose of the volatile oil is 0.06 to 0.18 c.cm. (or *mi*-iij) ; a fluid extract and an infusion, 4 Gm. to 473 c.cm. (or ʒi-Oj) are also popularly used.

Physiological Action.—Tansy is an aromatic, bitter tonic, and, by virtue of its volatile oil, it is diuretic and emmenagogue. Large doses, 15 c.cm. (or fʒss) or more of the oil, taken to produce abortion, cause disturbance of the respiration, depression of heart's action, clonic spasms, stupor, and death; sometimes it causes abortion, but only because of its violent irritant action upon the gastro-intestinal tract, which may lead to inflammation.

Poisoning.—The treatment of an overdose is the free use of demulcents and purgatives to clean out the stomach and bowels, followed by opium, bismuth, and diffusible stimulants.

Therapy.—Tansy is a useful ingredient in functional dysmenorrhœa, amenorrhœa, and ovaralgia, in doses of 0.03 to 0.06 c.cm. (or *m*ss-j), in pill, or dropped on sugar. In suppressed menstruation from cold it may be given in conjunction with hot drinks and hot applications. It has some anthelmintic effects, but should not be used for this purpose.

TANNALBIN is a preparation of tannin and albumin combined by exposure to a temperature of 110° to 120° C. for five or six hours. It represents 50 per cent., by weight, of tannin. It is a light-brown powder, insoluble in water and the gastric secretions, soluble slowly in intestinal fluids. It is gently astringent, non-toxic, and not irritating. It is used in various forms of diarrhœa. Dose for adults, 1 to 2 Gm. (or gr. xv-xxx). In infants the single dose is 0.10 Gm. (or gr. iss) for every year of the child's age, given two to four times daily. In follicular enteritis and tubercular disease of intestines, the preliminary administration of castor-oil is recommended by Friedjung. Porter found it useful in gastric catarrh with fermentation. In rectal disorders, tannalbin may be added to a starch enema.

TANNIGEN.—This is a derivative of tannic acid in which two acetyl and three hydroxyl groups are present. Tannigen was prepared by Meyer in order that it might pass through the stomach unchanged and exert the influence of tannic acid upon the intestine. It is a yellowish-gray powder, soluble in water and alkaline solutions. The substance is devoid of taste, does not disturb the appetite or digestion, and may be given for a considerable period without producing tolerance or habit. It has generally been given internally in doses of 0.20 to 0.50 Gm. (or gr. iii-viij) thrice daily, but from 2.60 to 4 Gm. (or gr. xl-lx) can be taken without bad results. Tannigen proved useful in diarrhœa, more particularly in chronic cases. Its effect was less decided in acute diarrhœa, or that of tubercular origin. Tannigen has been employed, also, in chronic inflammation of the nose and throat.

TANNOFORM is a condensation product of tannin and formaldehyde. It occurs as a loose, reddish-white powder, which is odorless and insoluble in water. It is antiseptic and desiccant, in 20 to 50 per cent. triturations with powdered starch. It is especially useful in bromidrosis and hyperidrosis of

the feet. In eczema it has been applied as an ointment (10 per cent.), which also is useful to relieve the itching of hæmorrhoids. Tannoform is also used as an astringent and intestinal antiseptic, chronic diarrhœa, especially in infantile diarrhœa. The dose for an adult is 0.25 to 0.50 Gm. (or gr. iv-viij). It passes through the stomach unchanged, and even in large doses causes no irritation of the stomach.

TANNOPIN.—Tannopin is a condensation product of tannin (87 per cent.) and hexamethylenamine (13 per cent.), and was originally introduced by Nicolaier in the treatment of affections of the urinary organs. It is a brown powder, insoluble in most ordinary solvents, but splits up into its constituents by the alkaline intestinal juice. Its antiseptic and astringent value in catarrh of the bladder having been asserted, Schreiber, of Ebstein's clinic, tried it in thirty-two intestinal cases, including acute and chronic catarrh, tuberculous enteritis, and typhoid fever, giving doses of $^1/_2$ to 1 Gm. (or gr. viiss-xv) three or four times a day with very good results, especially in the tuberculous patients. Carl Fuchs reports five cases of the use of this agent for diarrhœa. The first was one of tuberculous enteritis in a case of acute general tuberculosis; 4 Gm. (or gr. lx) a day of tannopin were given for two days, with the result that the daily number of motions fell from twelve to one. The second case was one of acute diarrhœa, which was rapidly cured, as were also the third, fourth, and fifth patients, suffering, respectively, from heart trouble (which had been too vigorously treated with digitalin), phthisis, and chronic diarrhœa of uncertain origin. The sixth patient, whose diarrhœa came on in the course of Bright's disease, did not react quite so satisfactorily; tannopin was given for some weeks, but the diarrhœa did not cease entirely, though the stools were reduced in number from five to two a day. In a case of cystitis the smarting during micturition diminished, the flow of urine increased, and the urine itself became clearer and less purulent. The frequency of micturition was not diminished, but the amount passed each time was increased. In this respect, tannopin is undoubtedly inferior to urotropin, its action on the urinary passages being only symptomatic; this was the conclusion arrived at by Schreiber as well. As regards the intestines, it rapidly diminishes the watery stools in acute enteritis, but in chronic diarrhœa its action is less constant, causing in some cases complete stoppage, in others only limitation in the number of the dejections.

TARAXACUM (U. S. P.).—**Dandelion.**

TARAXACI RADIX (B. P.).—**Taraxacum-root.**

Preparations.

Fluidextractum Taraxaci (U. S. P.).—Fluid Extract of Taraxacum. Dose, 4 to 7.5 c.cm. (or f3i-ij).

Extractum Taraxaci (U. S. P., B. P.).—Extract of Taraxacum. Dose, 0.65 to 2.60 Gm. (or gr. x-xl). B. P., 0.32 to 1 Gm. (or gr. v-xv).

Extractum Taraxici Liquidum (B. P.).—Liquid Extract of Taraxacum. Dose, 2 to 7.5 c.cm. (or f3ss-ij).

Succus Taraxaci (B. P.).—Juice of Taraxacum. Dose, 4 to 7.5 c.cm. (or f3i-ij).

Pharmacology.—"The dried root of Taraxacum officinale (Cichoriaceæ), collected in the autumn" (U. S. P.). It is a well-known common

perennial of the fields of America and Europe, bearing a yellow head of flowers on a slender peduncle, from a cluster of radical leaves. All parts of the plant contain a milky, acrid juice, which exudes when the plant is cut or bruised. It contains **asparagin** (found also in asparagus, marshmallow, licorice-root, wahoo or euonymus, the potato-plant, and the root of the locust-tree and elsewhere), which has little, if any, therapeutical value. The active principles, according to Sayre, are **Taraxacin** and **Taraxacerin**; the former is dissolved out by hot water, the latter by alcohol. The root also contains inulin, mannite, and resin. **Leontodin** is an eclectic preparation made by precipitation from the tincture. It is an impure extract of taraxacum and is given in doses of 0.065 to 0.13 Gm. (or gr. i-ij).

Physiological Action.—Dandelion preparations are bitter, and probably stimulate the digestive secretions and act as a tonic. It is a feeble, hepatic stimulant (Rutherford). It is a laxative, and also diuretic.

Therapy.—In deficient secretion of gastric juice or of the bile in atonic dyspepsia and torpid liver, taraxacum acts as a mild stomachic and is of service in duodenal dyspepsia. Dandelion is also prescribed in catarrhal jaundice. It has no specific action in liver disorders, but is often combined with other remedies which have such effect:—

℞ Potassii iodidi ..... 4| Gm. or 3j.
Fluidext. taraxaci,
Syr. glycyrrhizæ ..... aa 60| c.cm. or f℥ij.
M. Sig.: A tablespoonful four times daily, for cirrhosis of the liver.

The fluid extract of taraxacum is an acceptable vehicle for nitrohydrochloric acid or ammonium chloride.

TEREBINTHINA (U. S. P.).—**Turpentine.**

TEREBENUM (U. S. P., B. P.).—**Terebene.** A liquid consisting of dipentene and other hydrocarbons, obtained by the action of sulphuric acid on oil of turpentine and subsequent rectification by steam (U. S. P.).

Dose, 0.30 to 1 c.cm. (or *m*v-xv).

Preparations.

Terpini Hydras (U. S. P.).—Terpin Hydrate. Dose, 0.65 to 1.30 Gm. (or gr. x-xx).

Oleum Terebinthinæ Rectificatum (U. S. P.).—Rectified Oil of Turpentine (redistilled from lime-water. Rectified oil of turpentine should always be dispensed when oil of turpentine is required for internal use). Dose, 0.30 to 1 c.cm. (or *m*v-xv), or, as an anthelmintic, 15 c.cm. (or f℥ss).

Oleum Terebinthinæ (U. S. P., B. P.).—Oil of Turpentine. For external use.

Emulsum Olei Terebinthinæ (U. S. P.).—Emulsion of Oil of Turpentine. Dose, 4 c.cm. (or f℥j).

Linimentum Terebinthinæ (U. S. P., B. P.).—Turpentine Liniment (resin cerate, 65 parts; oil of turpentine, 35 parts, U. S. P. Soft soap, 62 Gm., or ℥ij; distilled water, 155 Gm., or ℥v; camphor, 31 Gm., or ℥j; and oil of turpentine, 390 c.cm., or f℥xiij, B. P.).

Linimentum Terebinthinæ Aceticum (B. P.).—Liniment of Turpentine and Acetic Acid (oil of turpentine, 100 c.cm.; glacial acetic acid, 25 Gm.; liniment of camphor, 100 c.cm.).

Linimentum Cantharidis.—Cantharides Liniment (cantharides, 15 parts; oil of turpentine, 85 parts). A strong counter-irritant.

Pharmacology.—Turpentine is "a concrete oleoresin, obtained from Pinus palustris, and from other species of Pinus (Coniferæ)." It consists of a volatile oil, which is known as oil of turpentine, or, incorrectly, spirit

of turpentine, and resin. The oil is distilled from any variety of Pinus capable of furnishing it, though the B. P. oil is distilled usually by the aid of steam, from the oleoresin obtained from Pinus sylvestris, and other species of Pinus; rectified, if necessary; and, at first, is a thin, limpid liquid, but afterward gradually absorbs oxygen from the air and forms resin, which makes it thicker. Old oil of turpentine is an ozonizing agent, and is recommended in cases of phosphorus poisoning. Chian turpentine (Pistacia terebinthus), coming from Chio and Cyprus, does not materially differ from the ordinary form, except that it has a more agreeable odor, resembling that of lemon or fennel; it is produced by a larch-tree (Anacardiaceæ), and may be given in doses of 0.20 to 0.32 Gm. (or gr. iii-v), in an emulsion. White turpentine (Thus Americanum, B. P.), identical with the solid matter deposited by turpentine upon standing, is the spontaneous exudation upon the tree, which is scraped off and sent to market in yellowish-white masses. The various forms of turpentine are soluble in alcohol, forming what is commonly called varnish. Turpentine is very inflammable, and burns with a heavy cloud of black smoke of unconsumed carbon. The oil is inflammable and explosive. The oil of turpentine possesses a peculiar, characteristic odor and taste, has a specific gravity of 0.855 to 0.870, is soluble in alcohol, ether, chloroform, glacial acetic acid, benzol, and insoluble in water. It is a solvent for wax, iodine, sulphur, phosphorus, and fixed oils. Rectified oil of turpentine is oil which has been redistilled; it is the only form suitable for internal administration.

Canada Turpentine, not a balsam, is official as Terebinthina Canadensis. It is a liquid oleoresin, obtained from Abies balsamea, used principally in the arts and in mounting microscopical objects.

Catramine is closely related to turpentine, but contains a larger proportion of resin than the latter. Its physiological action resembles that of the oil of turpentine. It is eliminated in the urine in the form of a resin, and is recommended by Vincenzo Gauthier in chronic bronchial affections with profuse secretion.

Physiological Action.—The oil of turpentine has well-marked antiseptic qualities. When applied to the skin it produces redness, tingling, and irritation, and may cause inflammation and blistering. In some cases it even gives rise to ulceration. Some persons are very susceptible to its effects, and the local application will cause marked systemic disorder, with an erythematous rash. Desquamation may follow. Taken by the mouth, turpentine will likewise occasionally give rise to an erythematous, vesicular or papular eruption. In small doses (0.60 to 1.20 c.cm., or *m*x-xx), oil of turpentine is a stimulant; in large amounts, an irritant. Doses of 4 to 7.5 c.cm. (or f3i-ij) cause burning in the mouth and stomach, with thirst; larger quantities give rise to vomiting and purging, with tenesmus; these effects, however, may be avoided by combination with other agents, and especially demulcents. Koutonzoff declares, as a result of experiments upon six healthy men, that turpentine dissolves the albuminoids of the food in the stomach when hydrochloric acid is still absent; that it first diminishes and subsequently increases the secretion of the gastric juice; that it moderately excites the motility of the stomach and the absorbent power of the mucous membrane. Upon the circulation, the effects are those of a cardiac stimulant, the pulse is increased in force and in frequency, but toxic doses occasion collapse, with feeble pulse. According to Kobert, medicinal doses increase the blood-

pressure by "powerfully stimulating the inhibitory reflex centre, and also the vasomotor centre," but very large doses paralyze both centres, the blood becoming dark and the heart paralyzed. Injection of oil of turpentine into the vessels causes lowering of blood-pressure, with increase of pulse-rate. In small doses it produces vascular contraction. From the very diffusible nature of this substance, it readily finds its way into the circulation, and is carried to the nerve-centres. After poisoning by it, the brain has the characteristic odor of turpentine; it has, therefore, been inferred by Bartholow that it exerts a direct influence upon the nerve-cells. It is through the nervous system that its effects are mainly manifested. After moderate or continued doses, slight exhilaration, like that following alcohol, is observed, followed by an hypnotic effect; toxic amounts cause delirium, with depressed intellection or stupor, impaired physical power, defective co-ordination (followed by paralysis), coma, with dilated pupils, and death. Such amounts have, in addition, caused complete muscular relaxation, profound insensibility, and abolition of all reflex movements. Six ounces have occasioned death in an adult, preceded by opisthotonos; "the brain, heart, lung, and viscera were found gorged with blood."

Turpentine is eliminated by the skin and bowels, but principally by the bronchial mucous membrane and kidneys. Its odor is perceptible in the breath. It communicates to the urine a smell similar to that of violets, though, when the dose has been large, the urine possesses a terebinthinate odor. Heat and dryness of the skin and pruritus sometimes result from the internal use of turpentine.

Treatment of Poisoning.—Where persons have been made sick by the vapor of turpentine, as by sleeping in a newly-painted room, it is necessary to give them a supply of pure, fresh air, with cardiac stimulants and diuretics, encouraging the action of the kidneys and skin by hot drinks and pilocarpine. If large amounts have been swallowed, after emptying the stomach and bowels by hot water and milk, and copious enemata, demulcents with opiates are required.

Therapy.—Oil of turpentine is a valuable counter-irritant in peritonitis, pneumonia, bronchitis, asthma, and painful disorders, such as lumbago, pleurodynia, myalgia, etc. A turpentine stupe consists of a piece of flannel heated by steam or by being wrung out of hot water, with a few drops of turpentine sprinkled upon its surface just before application. Spongiopilin may be similarly used. A mixture of equal parts of turpentine and yelk of egg is also serviceably applied to the skin for the same purpose. A turpentine stupe should be removed as soon as it causes pain. In rheumatic joints a liniment containing turpentine is useful, but the official liniment requires dilution:—

℞ Liniment. terebinthinæ,
Tr. opii ..... aa 30 | c.cm. or f℥j.
Lin. saponis ..... 90 | c.cm. or f℥iij.
M. Sig.: For external use in rheumatism, to be used with friction.

In peritonitis turpentine can be applied over the abdomen, either alone or combined thus, with much benefit:—

℞ Olei terebinthinæ,
Olei olivæ ..... aa 60 | c.cm. or f℥ij.
Ungt. hydrargyri ..... 62 | Gm. or ℥ij.
M. Sig.: Apply warm with flannel over the abdomen, in peritonitis.

Preparations containing turpentine are advantageous external applications in inflammatory affections of the larynx, pharynx, and tonsils. In diphtheria it has been beneficially employed as a topical remedy, being applied by means of a brush, or administered in the form of a spray or by inhalation of the vapor. Dr. Charles Smith has derived advantage in diphtheria from the continuous inhalation of a mixture composed of 1 part each of carbolic acid and eucalyptus-oil and 8 parts of turpentine. Cloths saturated in the fluid are hung or laid near the face of the patient, care being taken that they do not come in contact with the skin.

In order to render the air-passages aseptic, Delthil recommends inhalation of the following mixture:—

℞ Olei terebinthinæ rectificat.	330	c.cm. or f℥xj.
Spiritus lavandulæ	90	c.cm. or f℥iij.
Iodoform.	10	Gm. or ʒiiss.
Æther. sulph.	18|5	c.cm. or f3v.—M.

The oil of turpentine has been used with success in the treatment of severe burns, accompanied by constitutional depression. Dr. H. McInnes says that this treatment will at once relieve the pain; and the burn will heal more rapidly than by any other treatment. He advises laying a thin layer of absorbent cotton over the burn and then saturating it with the commercial oil of turpentine, and apply a light bandage. As the turpentine evaporates, more should be added, in order to keep the compress wet. When there are large blebs, he opens them on the second or third day. The turpentine should not be applied to the healthy skin, as it may act as a counter-irritant and cause pain.[1] A tablespoonful of turpentine is a useful addition to a large enema, especially when given for flatulent colic. Turpentine enemata also assist in combating the stupor of narcotic poisoning and are useful derivatives in sun-stroke and cerebro-spinal meningitis. Turpentine is efficacious in the treatment of chilblains. An ointment of turpentine, official in the British Pharmacopœia of 1890, is used with advantage in chronic eczema, psoriasis, and alopecia circumscripta. It may also be applied with good effect to unhealthy or indolent ulcers.

Internally, the oil of turpentine is antiseptic and astringent in some forms of diarrhœa, especially of a catarrhal character.

It is valuable in acute dysentery after the violence of the attack has somewhat subsided. Turpentine is likewise useful in epidemic dysentery. A few drops of this oil form an excellent remedy in flatulence and may be of benefit in ulcer of the stomach or bowels. In typhoid fever, small doses, given in conjunction with the mineral-acid treatment, are a valuable adjunct, especially when the tongue is red, dry, and clean, and there is abdominal distension. It is best given in the official emulsion:—

℞ Ol. terebinthinæ rectificat.	15|	c.cm. or f℥ss.
Ol. amygdalæ expressi	5|	c.cm. or 3j$^{1}/_{4}$.
Syrupi	25|	c.cm. or 3vj$^{1}/_{4}$.
Pulv. acaciæ	15|5	Gm. or ʒiv.
Aquæ q. s. ad	100|	c.cm. or f℥iiiss.

M. secundem artem.

Sig.: One tablespoonful every two or three hours in typhoid fever, or the whole amount may be taken at once to remove a tape-worm.

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[1] *Medical Record*, Sept. 5, 1896.

The rather unpleasant taste of turpentine may be disguised by the addition of glycerin in the proportion of about 4 c.cm. (or f℥j) to 30 c.cm. (or f℥j) of mixture. Glycerin, with the addition of a drop or two of oil of gaultheria, is said to disguise the taste of turpentine.

This remedy is, furthermore, valuable in typhoid fever by relieving tympanites and restraining hæmorrhage. If diarrhœa persist or recur during convalescence from this disease, recourse should be had to turpentine. In various forms of hæmorrhage turpentine is valuable, as in hæmaturia, purpura hæmorrhagica, and in gastric ulcer. It has been found efficient in post-partum hæmorrhage, and is peculiarly valuable in this condition on account of the rapidity of its action. Turpentine also checks the bleeding of scurvy. It is especially in passive hæmorrhage that this remedy is of service. In hæmaturia it has likewise been given with success, but it must be employed only in small doses, and its effects very carefully watched. The unpalatable taste of this liquid is not infrequently a bar to its administration. When the dose consists of but a few drops it may be given in a capsule.

In chronic cystitis, pyelitis, and gleet, and in bronchorrhœa, small doses of oil of turpentine check the discharge and act as an antiseptic. Incontinence of urine, spermatorrhœa, and prostatorrhœa dependent upon relaxation are not infrequently relieved by turpentine. In addition to its strictly therapeutical effects turpentine is serviceable in incontinence of urine by overcoming the odor due to the dribbling of the fluid and converting it into a scent resembling that of violets. In low fevers the addition of 4 c.cm. (or f℥j) of this oil to a hot punch often rouses the patient from a condition of stupor, and acts as a stimulant to the circulation. As a cardiac stimulant, turpentine is of service in puerperal fever, phlegmonous erysipelas, and yellow fever, in capillary bronchitis, pneumonia, and emphysema. In gangrene of the lung it diminishes fœtor. The vapor of steam, impregnated with turpentine, is employed for inhalation in laryngeal and bronchial disorders.

A mixture of turpentine and ether (equal parts) is supposed to have some influence in removing gall-stones, but it is not probable that it has much effect in dissolving them, as was claimed by Durande; the effects are those of a carminative and antispasmodic. It is useful in this combination (1 part to 3 of ether) in colic as an anodyne. Dr. Hughlings Jackson used oil of turpentine in chorea.

The vapor of turpentine has been used in Germany as a prophylactic against influenza. The United States Consul at Frankfort reports that during a recent epidemic of influenza, it was found that the workmen in a certain factory who were exposed to evaporating oil of turpentine, seemed to be protected from the disease. Further trials confirmed this observation.

In erysipelas, oil of turpentine may be painted on the surface and taken internally. It is a good local application in ringworm, and has been also employed successfully in some cases of psoriasis by Dr. Crocker in the form of an embrocation with olive-oil (1 to 4), gradually increasing the strength until the pure turpentine-oil is used. The same writer has derived good results in psoriasis and chronic eczema from the internal administration of oil of turpentine in doses of 0.60 to 2.50 c.cm. (or *m*x-xl) in emulsion after each meal. King Chambers has found that an enema containing 15 c.cm. (or f℥ss) of the oil, or more, is of great value in sciatica; in which affection this remedy is sometimes beneficially given internally in 15-c.cm.

(or f℥ss) doses, repeated for several successive nights. In other forms of neuralgia it has proved of service. It seems to be of particular value in debilitated or aged subjects, in whom degeneration of nerve-tissue has occurred. In such cases 7.5-c.cm. (or f℥ij) doses have been found more efficient than smaller quantities. Phillips thinks turpentine particularly indicated when neuralgia is of rheumatic origin. The oil is of undoubted efficacy in chronic rheumatism, relieving the pain and checking the progress of the disease. Amendment takes place under the influence of turpentine in rheumatic sclerotitis, iritis, and choroiditis. Nervous headache is sometimes relieved by this agent; 1.20 c.cm. (or *m*xx) of turpentine thrice daily is strongly recommended in lumbago by Dr. George Bird. According to Begbie, turpentine is of service in hydatid cysts, especially of the lung. Phillips has found this remedy, in doses of 0.06 to 0.12 c.cm. (or *m*i-ij), night and morning (not fasting), to be of service in certain chronic cases of albuminuria unattended by pronounced symptoms of Bright's disease, reducing the amount of albumin and improving the general condition.

As a general rule, the addition of 4 to 7.5 c.cm. (or f℥i-ij) of oil of turpentine to an enema makes it more stimulating, and therefore this expedient can be adopted in narcotic poisoning. An enema containing turpentine relieves flatulence and constipation, and, as a derivative, is of value in sun-stroke and cerebro-spinal meningitis. As an anthelmintic, it may be combined with castor-oil and is very effective against round worms as well as tænia.

Caution.—Being a stimulating diuretic, the oil of turpentine should be used with caution, as it is apt to produce frequent and painful micturition, with bloody urine, strangury, and inflammation of the kidneys. These symptoms may result from constant inhalation of its vapor. Hæmaturia is not uncommon among sailors engaged on vessels carrying turpentine. Priapism, menorrhagia, and dysmenorrhœa are sometimes occasioned by turpentine. The free use of barley-water and other demulcents, the hot bath, and free purgation will generally quickly relieve the symptoms, unless nephritis should occur. Turpentine should not be employed when cardiac hypertrophy or atheroma of vessels exists.

Chian turpentine was formerly recommended as curative in scirrhus and other malignant disease of the uterus by Mr. Clay, of Manchester. This writer insisted that the drug should be pure, that its use should be begun at an early stage of the disease and continued for a year after the manifestations have disappeared or the tumor has been removed by operation. Its administration in doses of 0.32 to 1 Gm. (or gr. v-xv) has likewise been followed by improvement in pityriasis rubra. The solid form is not an eligible method of administration when it is to be continued for any length of time, as it has been known to accumulate and form a mass in the stomach.

Terebene is obtained by subjecting oil of turpentine to the action of sulphuric acid and distilling at a temperature of 160° F. It is a clear, mobile liquid, having a peculiar, fresh-pine odor and pungent taste; freely soluble in alcohol, chloroform, and ether, but sparingly soluble in water. In doses of 0.30 to 1.20 c.cm. (or *m*v-xx), it is given with benefit in winter cough, with muco-purulent expectoration, by Dr. Murrell. He finds it useful as an antiseptic in flatulent dyspepsia; also in cystitis and gleet. In diseases of the genito-urinary tract, it can be prescribed as follows:—

℞ Terebeni ..... 6|20 c.cm. or *mc.*
Tinct. belladonnæ folior. ..... 4| c.cm. or *m*lx.
Phenylis salicyl. ..... 6|50 Gm. or gr. c.

M. et ft. capsulæ no. xx.

Sig.: From four to six capsules a day, in gleet, stricture, and irritation of the bladder.

In bronchitis and bronchorrhœa, in emphysema, in catarrhal affections of the upper air-passages, even in phthisis, it has been found highly valuable for inhalation. It has no specific action when administered in phthisis, but probably exerts some local astringent and antiseptic effect upon the bronchial mucous membrane, by which it is chiefly excreted. Terebene has been used with benefit in puerperal fever. In genito-urinary disease it has been given as a substitute for oil of sandal-wood. It should be administered in capsules in the dose of 0.30 to 0.60 c.cm. (or *m*v-x), repeated every three hours. In some cases it irritates the stomach, and might then be made into an emulsion. In other instances terebene has had a similar effect upon the bowels or kidneys. A 5-per-cent. aqueous solution of terebene has been locally used as a disinfectant wash in surgical cases.

Terebinthine, a hydrocarbon of similar composition, is obtained by distilling oil of turpentine with an alkali. By hydration, it is converted into terebinthine hydrate, commonly called **terpin hydrate,** a crystalline, solid body, soluble in glycerin, water, and alcohol. It dissolves sparingly in ether and chloroform. Terpin hydrate occurs in the form of large colorless rhombic crystals, destitute of odor and having a faint aromatic taste.

Terpin hydrate is "the hydrate of the diatomic alcohol terpin" (U. S. P.). It was used by Manasse in forty-one cases of whooping-cough. No ill effects upon kidneys or bowels were observed in children from doses of 1.30 Gm. (or gr. xx). In doses of 1 to 3 Gm. (or gr. xv-xlv), according to age, the severity of the convulsive attacks was notably moderated. Dr. Talamon makes use of the following combination:—

℞ Terpin. hydrat.,
Antipyrin. ..... aa 1| Gm. or gr. xv.
Syr. aurant. cort.,
Mucilag. acaciæ ..... aa 60| c.cm. or f℥ij.

M. Sig.: One or two ounces several times a day for a child under four years of age.

As a local application for diphtheria, Dr. Hutinel uses, in the Hôpital des Enfants Malades:—

℞ Terpin. hydrat. ..... 8| Gm. or ℥ij.
Hydrarg. chlorid. corros. ..... |28 Gm. or gr. ivss.
Spiritus menthæ pip.,
Sp. vini rectificat. ..... aa 90| c.cm. or f℥iij.
Spiritus thymi ..... |37 c.cm. or *m*vj.—M.

Dr. Hugo J. Loebinger, of New York, uses terpin hydrate with advantage in hay asthma, giving it in 1 to 1.30 Gm. (or gr. xv-xx) doses. Terpin hydrate, being a solid, is given in capsules, in bronchial affections, coughs, catarrhs, colds, etc., in doses of 0.13 to 0.65 Gm. (or gr. ii-x).

Dr. William Murrell, of London, prescribes terpin hydrate in a solution containing 0.32 Gm. (or gr. v) to 15 c.cm. (or f℥ss), made up with simple elixir and flavored either with syrup of wild cherry, syrup of tar, or cherry-laurel

water. For patients who cannot take sugar the elixir may be made with saccharin. According to Dr. Murrell, terpin hydrate also possesses diuretic properties and has been used with advantage in neuralgia. It should not be confounded with a body of similar name, terpene, found in eucalyptus.

TEREBINTHINA CANADENSIS (U. S. P., B. P.).—**Canada Turpentine.** The fir, Abies balsamea (Pinaceæ), is indigenous to the northern part of the United States and Canada. The balsam, or liquid oleoresin, is obtained by collecting the juice, which naturally exudes, and through spontaneous evaporation. It is a viscid, nearly transparent, yellowish liquid, of rather pleasant odor and bitterish taste, completely soluble in ether, chloroform, or benzol. The balsam is said to contain about 20 per cent. of volatile oil. When dried it is a clear mass, entirely without structure; so that it is useful in microscopical work.

Physiological Action and Therapy.—In their actions upon the human body the various forms of turpentine resemble each other so closely as not to require separate treatment. It is probable that the good effects obtained by Mr. Clay and Paracelsus, in the treatment of uterine disease with Chian turpentine, might be obtained from our native turpentine. It may be administered in capsule or emulsion, and may also be applied locally. When given in substance, it may form a concretion in the stomach. As a surgical dressing it also is useful, owing to its adhesive and antiseptic qualities, resembling, in this respect, the balsam of Peru.

TEUCRIUM.—Water-germander, Woodsage. The leaves and flowering tops of Teucrium scordeum (Labiatæ), growing abundantly in Central Europe and naturalized in some of the States along our Atlantic coast, possess medicinal properties. The taste is bitter and decidedly astringent. The virtues of the plant depend upon an oleoresin. Teucrium also contains an essential oil, which is warm and somewhat pungent to the taste. It may be given in the form of an infusion, the dose of which is 30 to 60 c.cm. (or f℥i-ij), or of a fluid extract. The dose of the latter preparation is 4 to 7.5 c.cm. (or f℥i-ij).

Physiological Action and Therapy.—Teucrium possesses astringent and stimulant properties. Dr. John W. Eckfeldt reports that it is a useful antispasmodic in certain nervous disorders, as whooping-cough and hysteria of uterine origin. A syrup of teucrium is a good expectorant, restraining excessive secretion, and of especial service in the treatment of nervous coughs. The same observer has found this remedy of service in amenorrhœa and subacute rheumatism. He states that it has been used as an alterative in scrofulosis. Teucrium is particularly valuable in enlargement of the prostate and in hæmorrhoids. In the latter affection it may be used with good effect in the form of a suppository, and alleviates the itching.

THALLIN.—Tetra-hydro-parachinanisol [$C_9H_6H_4N(OCH_3)$]. Thallin, a compound of the aromatic series, exhibits the form of colorless, rhombic crystals, soluble in water, alcohol, and ether. It forms salts with tartaric, tannic, hydrochloric, and sulphuric acids. The sulphate, which has been most generally employed, is a whitish, crystalline powder, of an aromatic smell and taste. Thallin sulphate is readily soluble in water, but sparingly so in alcohol.

Physiological Action. — Thallin possesses powerful antiseptic virtues, and a 4- to 5-per-cent. solution is capable of destroying micro-organisms. Large doses depress cardiac energy and reduce blood-pressure. It rapidly lowers febrile temperature by increasing the dissipation of heat, and the effect may continue for several hours,—though, as a rule, it is of rather brief duration. The reduction is often accompanied by profuse sweating and extreme prostration. Vomiting and diarrhœa, chills, cutaneous rashes, cyanosis, or albuminuria may follow its administration. Thallin is speedily eliminated by the kidneys. Solutions of thallin sulphate assume a brownish color when exposed to air and light. In its elimination this substance communicates a dark discoloration to the urine.

Therapy.—Thallin salts were used with advantage as an injection in gonorrhœa, the strength of the solution being from 2 to 2 $^1/_2$ per cent. In gleet a weaker solution has given a favorable result. When administered for reducing fever, thallin sulphate has been employed in hourly doses of 0.032 to 0.065 Gm. (or gr. ss-j). In tuberculosis it reduces temperature very rapidly, but, even in small amounts, is apt to occasion alarming prostration. Professor Demme recommends thallin in the treatment of typhoid fever of children. Other observers have spoken favorably of the influence of thallin in the febrile affections of children. Dr. J. P. Crozer Griffith has derived good results from its use in measles, scarlet fever, and other diseases characterized by high fever and severe nervous manifestations.

THEOBROMA.—Cacao, Chocolate.

Preparation.

Oleum Theobromatis (U. S. P., B. P.).—Oil of Theobroma, Cacao-butter.

Pharmacology.—The prepared and dried, ripe seeds of the Theobroma Cacao (Sterculiaceæ) are oval, and consist of shells and kernels, both of which contain an alkaloidal principal called **Theobromine** (about 2 per cent.), similar to caffeine (the former being dimethyl-xanthine, the latter trimethyl-xanthine), also a yellowish-white, solid oil, known as **Cacao-butter** (up to 50 per cent.), with a faint, characteristic, pleasant odor. This is almost tasteless, and has a neutral reaction, melting at the temperature of the surface of the body. It is nutritious, but in medicine is chiefly valuable as a basis for suppositories, and for external application in massage. Chocolate is an article of food prepared from the roasted kernels, which are ground into a fine paste with sugar and flavored with vanilla. When this is added to boiling milk in proper proportion, a pleasant restorative article of diet is made, but rather oily, on account of the presence of the cacao-butter. When the cacao-butter is partly removed by pressure and the kernels prepared, as before, it is popularly known as breakfast cocoa,—an unfortunate name, since it causes confusion by resembling coco, or the coconut tree, and coca, or the erythroxylon coca, the latter also being the source of an exhilarating beverage used in South America. Cacao-butter is chiefly stearin; it does not become rancid. It has been substituted in a milk-food for infants in order to supply the deficiency of fat, since in all these preparations most of the cream has to be removed, because it cannot be kept without developing fatty acids. Cacao-butter is largely used in making suppositories, of which the following may be taken as an illustration:—

℞ Ext. krameriæ		32 Gm. or gr. v.
Ext. opii		03 Gm. or gr. ss.
Ol. theobromatis	1	Gm. or gr. xv.

M. et ft. suppositorium no. j. Mitte tales no. vj.
Sig.: Insert one at night for irritable hæmorrhoids.

In preparing suppositories, the addition of spermaceti causes the mass to congeal more rapidly and renders it less apt to adhere to the molds. There is but one official suppository in the United States Pharmacopœia, that of glycerin, which is made with glycerin, stearic acid, and sodium carbonate. Those official in the British Pharmacopœia (besides the glycerin) are Acidi Carbolici, Acidi Tannici, Belladonnæ, Iodoformi, Morphinæ, and Plumbi Composita, all of which contain this ingredient.

It has been suggested that **Oleum Cocois** (U. S. P.), or Coprah-oil, may be advantageously used in preparing suppositories. This consists of coconut-oil (from Cocos nucifera) freed from its more liquid portion. It congeals at 28° C. (82.4° F.), and possesses the advantages of solidifying rapidly, of contracting in the molds, and of being able to take up a large proportion of water.

Physiological Action.—The physiological effects of theobromine are analogous to those of caffeine, but it does not stimulate the central nervous system to anything like the same extent, and is poisonous only in doses five or six times as great as the latter drug. The effects upon the vasomotor centre in the medulla are also much less. W. Cohnstein concludes that in physiological doses, theobromine has no perceptible action upon the heart, but that excessive quantities cause a gradual fall of blood-pressure. Schroeder[1] demonstrated that caffeine acted as a diuretic by direct stimulation of the renal epithelium, and subsequently has shown that theobromine acts in the same way.[2] He also showed that theobromine was less poisonous, and that it was a more powerful and lasting diuretic. Gram[3] confirmed these observations, but found theobromine insoluble and likely to cause nausea. He, therefore, recommends a double salicylate of theobromine and sodium, containing about 50 per cent. of theobromine, as a substitute, which, from its effects, has been called **Diuretin.** This salt has a bitter taste; is a white powder, soluble in half its weight of hot water, and not depositing in cooling. It is best given in solution with an aromatic water; in syrups it is liable to deposit, and in powders it is apt to decompose in a short time. He gave it in 1 Gm. (or gr. xv) doses, five or six times daily. The action of diuretin upon the heart very closely resembles that of digitalis.

Gram has also written of a corresponding compound with lithium, a salicylate of theobromine and lithium, or **theobromine-lithium.** This preparation may effectively take the place of diuretin, being more readily absorbed than the latter and active in doses of 0.20 to 0.25 Gm. (or gr. iii-iv).

A combination of theobromine acetate and of sodium acetate (five parts to two of the latter) is known as **Agurin,** which is offered as an improvement upon diuretin (sodium salicylate of theobromine), and is said to be less irritating than the latter, and can be given even in mild grades of nephritis. Agurin is a white powder, easily soluble in water, and is slightly bitter.

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[1] *Archiv für Experiment. Pathologie,* xxii, 1886.
[2] *Ibidem,* xxiv, 1887.
[3] *Therapeutische Monatshefte,* Jan., 1890.

Dose, 1 Gm. (or gr. xv) three times daily. It is used to best advantage in dropsy due to heart diseases, and may be given with digitalis.

Therapy.—Diuretin has been tried in various diseases by Hoffmann,[1] who gave about 5 Gm. (or gr. lxxv) daily; he found it useful in pleuritic effusion. In acute nephritis, the amount of urine was tripled. In disorders of the circulation attending lesions of the heart, Hoffmann reports in all great diuresis, decrease in œdema, and strengthening of the pulse. The diuretic action is usually manifested within the first twenty-four hours, and gradually reaches its maximum between the second and the sixth day. It falls rapidly upon discontinuing the drug, or after the disappearance of the dropsy. The amount of albumin in the urine was not much affected, except that in the heart-cases there was distinct lessening. No cumulative effects were observed, and the theobromine was rapidly excreted in the urine. Dyspnœa, bronchitis, anorexia, and the general condition were all improved. Sometimes slight diarrhœa was noticed, but the drug was well borne by the stomach. Excitement and sleeplessness did not occur, but as the circulation improved the patient slept better. In some cases, where digitalis and strophanthus had failed to give relief, theobromine acted well, but, as a rule, it is not so generally useful. It may be combined with them in certain cases so as to assist in promoting diuresis. In Hoffmann's opinion it is much superior to caffeine. It has the advantage, over calomel and other mercurials, of acting upon the heart as well as the kidneys.[2] Diuretin is particularly valuable in the treatment of dropsy dependent upon cardiac failure. According to the observations of Pawinski it is more efficacious in affections of the heart-muscle than in valvular disease. In œdema due to renal lesions it is of value, but is seldom of use in ascites of hepatic origin. In some cases, after having been given for several days, diuretin will produce marked depression. Dr. Demme regarded diuretin as useful in the treatment of children. It causes a rapid disappearance of dropsy due to scarlatinous nephritis and of anasarca dependent upon cardiac lesion. He found it generally well tolerated, and that it can be given in the daily doses of 0.50 to 1.42 Gm. (or gr. viiss-xxij) to children from two to five years old and in proportionately larger amounts to older children. It is inappropriate, however, to infants less than a year old, on account of the gastro-intestinal irritation which it excites. In one case he witnesed a morbilliform eruption, with abundant diarrhœa, after ingestion of 6 Gm. (or gr. xc) within four days. Its action is more enduring than that of digitalin; it is not dangerous like calomel and does not produce nervous excitement like caffeine.

M. Huchard[3] has made extensive use of theobromine and concludes that it is superior to digitalis and caffeine as a diuretic. Its prolonged administration involves no inconvenience, provided that the daily dose does not exceed 5 Gm. (or gr. lxxv), and more especially if this quantity be given in fractional doses of 0.50 Gm. (or gr. viiss). Exceptionally it may, however, even in smaller doses, cause severe headache. Nausea and vomiting are rare, as is also cerebral excitement. Once only did the exhibition of the drug cause albuminuria, and in three instances only was previously existing albuminuria increased by it. In these latter cases the increased albuminuria coincided with rapid disappearance of the œdema. M. Huchard prescribes the

[1] *Archiv für Experiment. Pathologie*, xxviii, H. 1, 1890.
[2] Supplement to the *British Medical Journal*, Jan 3, 1891.
[3] Société Thérapeutique, Jan. 8, 1890.

theobromine after the following plan: 1st day, 3 Gm. (or gr. xlv) in fractional doses of 0.50 Gm. (or gr. viiss) in cachets; 2d day, 4 Gm. (or 3j) in 8 cachets; and 3d day, 5 Gm. (or gr. lxxv) in 10 cachets. This latter dose is continued for three or four days. In certain cardiac diseases he prolongs the diuretic action by the administration (consecutively) of 0.0005 to 0.001 Gm. (or gr. $^1/_{128}$-$^1/_{64}$) of digitalin given in one day. Theobromine is a direct diuretic, its action being to induce a heightened activity of the renal epithelium. Its employment is particularly indicated in arterial cardiopathies, in those complicated with renal lesions, in hyposystole (heart-failure), and in interstitial nephritis. The simultaneous exhibition of digitalis, caffeine, or lactose does not increase its diuretic action. Theobromine diuresis is not prolonged longer than three or four days, after the last dose is given. The drug is not cumulative or toxic; it succeeds often when digitalin or caffeine has failed; and it has apparently been of use in typhoid fever and pneumonia, where a free secretion of urine is of importance.

Cacao-butter is a good emollient and protective to apply to excoriated nipples of nursing women and to the thighs of children suffering with intertrigo. Cacao-butter suppositories offer a favorable method of administering remedies, especially in children. The following are appropriate doses for children: Belladonna (0.01 c.cm., or *m* $^1/_6$, of the tincture for a child of one year, in 24 hours, divided into three or four suppositories, and increase for every two years); bromides (1 Gm., or gr. xv, in 2 suppositories, for every year, repeated at short intervals in spasmodic affections, laryngismus stridulus, etc.); caffeine (0.10 Gm., or gr. iss, with an equal quantity of sodium benzoate, using 2 daily); digitalis (4 drops is the maximum dose of the tincture for each year, divided into two suppositories). Nux vomica (0.01 Gm., or gr. $^1/_6$, for every two years, in three suppositories); strychnine should not be given until after ten years of age; opium (powdered opium, 0.001 Gm., or gr. $^1/_{64}$, for each year, and repeated in ten hours, discontinuing immediately at onset of toxic symptoms; it should not be given to infants under two years of age); mercury (calomel, 0.048 Gm., or gr. $^3/_4$, for each year of life); iodides are well borne by the rectum and fully absorbed, 0.20 Gm. (or gr. iij), for each year of life, in two suppositories is the maximum dose; 0.048 Gm. (or gr. $^3/_4$), if it is to be continued.[1]

THERMOL (acetyl salicyl-phenetidin) is a white, crystalline, tasteless powder, devoid of aniline toxic properties; is soluble in cold water, more so in boiling water, and freely soluble in alcohol. Its action is that of an antipyretic, lessening increased tissue-combustion through its sedative power and controlling influence over the nervous system. Thermol is devoid of any depressant action on the heart, which makes it a valuable agent in fevers. Dr. Oliver L. Miller[2] states that, in twenty-six cases of typhoid fever treated at the Allegheny General Hospital, thermol reduced the temperature, without producing any deleterious effects on other organs. He also noted a shorter duration of the disease in the majority treated.

In whooping-cough a child one year old may take 0.065 Gm. (or gr. j) every two or three hours until physiological effects are produced. The dose for an adult as an antipyretic is from 0.25 to 0.50 Gm. (or gr. iv-viij).

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[1] *Médecine Moderne*; *Pediatrics*, May, 1898.
[2] *International Medical Magazine*, Feb., 1901.

In dysmenorrhœa, gout, rheumatism, and neuralgic headache, thermol is given in doses of 0.30 to 1 Gm. (or gr. v-xv).

THILANIN.—This name has been given to a combination of sulphur with lanolin. The compound, which contains 3 per cent. of sulphur, appears to differ from a mere mechanical mixture. It is as yet uncertain whether the sulphur is combined with the cholesterin or with fatty acids. Thilanin is an unctuous substance, of a yellowish-brown color and a sulphurous odor. It is devoid of irritant properties. In acute, subacute, and chronic eczema, the eczema of children, herpes, and sycosis, thilanin has proved of advantage. It can be mixed with aqueous or oleaginous fluids. This compound has been used with advantage in acne and psoriasis, and relieves the itching of various diseases of the skin.

THIOCOL.—This name has been given by Roche to guaiacol-sulphonate of potassium. It has the advantage over creosote and guaiacol in being soluble in water. It occurs as a white, microcrystalline, permanent powder, which is odorless and of a faint, bitter, saline taste, but not disagreeable. Thiocol is used for the same purposes clinically as guaiacol, and may be prescribed in powder, tablet, or with orange or cinnamon syrup, or any convenient vehicle. The commencing dose is 0.65 Gm. (or gr. x), gradually increased to 2 Gm. (or gr. xxx), three or four times daily. It is claimed to be free from toxic effects or irritation of the stomach, and is stated to be of special value in removing the symptoms of phthisis and favoring recovery.

THIOL is a chemical, composed of hydrocarbons and about 12 per cent. of sulphur. It occurs as a soft, gray powder, or scales, as prepared by Riedel, who also furnishes it in liquid form, which contains 40 per cent. of the base. Thiol is of agreeable odor and neutral reaction, is readily soluble in water, but is less soluble in alcohol and ether. It is free from local irritant effect. Dr. Laughlin has employed thiol ointment with success in eczema, acne rosacea, carbuncles, and boils. In facial erysipelas thiol constitutes an excellent application. A 20-per-cent. ointment is a useful application in frostbites and chilblains. Thiol is likewise of value in the treatment of burns. The powder is a good application to moist eczema, burns, erythema multiforme, and pemphigus. Liquid thiol forms a varnish which, with the addition of glycerin (5 per cent.), forms a brownish flexible protective layer. It is used in rosacea, eczema, herpes labialis, zoster, erythema nodosum, furunculosis, and burns. Thiol resembles ichthyol in chemical composition, and it may produce the same physiological and therapeutical effects. It is said to be non-toxic.

Thiol is employed for the same purposes as an antiseptic and local stimulant as ichthyol, over which it has the advantage of being more agreeable in odor.[1] In the daily dose of about 0.008 Gm. (or gr. $^1/_8$), thiol has been successfully given internally for the relief of constipation. Gottschalk employs it in cases of pelvic exudation, acute and chronic endometritis, a 10- to 20-per-cent. glycerin solution being used upon vaginal tampons and the abdomen rubbed once a day with a thiol ointment. Thiol ointment is irritant to the skin, and its use must be, from time to time, discontinued.

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[1] *Wiener klinische Wochenschrift*, No. 18, 1890.

Thiophen is a hydrocarbon belonging to the aromatic series; is a colorless volatile oil, insoluble in water, and possessed of a slight odor. Two combinations of thiophen have been made the subject of clinical experiment. **Sodium-sulphate thiophen** is a white, crystalline powder containing 33 per cent. of sulphur, half of which is combined with carbon. Its somewhat disagreeable odor is completely lost when it is made into a 5- to 10-per-cent. ointment. The ointment has no irritant effect upon the skin, and has been found beneficial in prurigo.

Thiophen di-iodide has been used as a substitute for iodoform. It is made by replacing two atoms of iodine for two atoms of hydrogen in thiophen. Thiophen di-iodide contains 75.5 per cent. of iodine and 9.5 per cent. of sulphur, both being in combination with carbon. The substance is crystalline, insoluble in water; soluble in alcohol, ether, and chloroform. It inhibits the development of the microbes of suppuration, and has been employed with success in the treatment of wounds and burns. This compound has been successfully employed by Topolanski, combined with sugar, in the treatment of conjunctivitis, catarrh of the lacrymal duct, and abscess of the cornea.

Thio-resorcinum.—Thioresorcin is a sulphur-substitution compound of resorcin. It is in amber-yellow crystals, and is used instead of iodoform in minor surgery. It probably might also be used internally, in the same doses as resorcin.

THIOSINAMIN. — Thiosinamin, or allyl-sulphocarbamid, is made by heating together 2 parts of allyl-mustard-oil, 1 part of absolute alcohol, and 7 parts of solution of ammonia. It is a white, crystalline substance, and possesses a slight aromatic odor. This compound dissolves in alcohol in the proportion of 1 part in 5, but is decomposed by solution in water. It is also soluble in ether. Injections of this substance are said to increase the quantity of urine excreted. They are productive of no injurious effect upon the kidneys. Thiosinamin promotes the absorption of exudations and of scar-tissue.

Therapy.—Thiosinamin has been used by hypodermic injection, principally in lupus. It was the subject of a communication by Hans Hebra in August, 1892, to the International Congress of Dermatology and Syphilology. The remedy was used by Hebra in doses of from 1 to 5 c.cm. (or *m*xv-lxxv) of a 5-per-cent. solution, injected twice a week under the skin of the interscapular region, alternately on the two sides. Subcutaneous injection of thiosinamin causes a local reaction of lupus, manifested by swelling of the diseased surface, continuing for four to six hours, gradually subsiding until, at the end of twenty-four hours, the skin had regained its former aspect. Constitutional symptoms do not occur. As a result of the operation, it is reported that lupous nodules retrocede, ulcers become clean, the elevated edges are leveled, and cicatrization takes place in a few weeks. Glas found it of service in five cases of rhinoscleroma. Dr. Sinclair Tousey, of New York, has met with great success by using thiosinamin injections for inoperable tumors, cicatricial contractures, and keloid.[1] Thiosinamin promotes resolution of enlarged lymphatic glands, especially in scrofulous or tuberculous subjects. This remedy has been considered as of service in the treatment of caries and necrosis.

[1] *New York Medical Journal*, lxiii, p. 579.

It is without influence upon syphilitic lesions. The injections are said to have a decided effect upon corneal opacities. Dr. Latzko has found the absorbent power of thiosinamin of service in gynæcological cases. Injections of 9.25 to 37 c.cm. (or f3iiss-x) of a 15-per-cent. solution caused the partial or complete removal of pelvic exudates and allowed malpositions of the uterus to be rectified.

Dr. Hanc, of Vienna, has made trial of thiosinamin in two cases of urethral stricture. He employed the remedy hypodermically, injecting at first half and subsequently a Pravaz syringeful of a 15-per-cent. alcoholic solution. He observed a rapid softening of the cicatricial tissue and an improvement in the symptoms, but the transformation was not permanent and the parts were not restored to the normal condition. Lengelmann in Mikulicz's clinic used it successfully in two cases of Dupuytren's contracture. One c.cm. of the solution (thiosinamin 2, glycerin 4, aquæ destillatæ 14 parts) was injected into the neighboring tissue daily. No ill effects were observed.

THUJA.—Thuja, Arbor Vitæ. The fresh tops of Thuja occidentalis (Pinaceæ), or white cedar,[1] growing in the northern United States, contain **Pinipicrin,** a bitter principle; **Thujin,** a yellow coloring principle. **Thujetin** is derived from the preceding. Its most important constituent is a **volatile oil,** which resembles savin in its physiological effects.

Therapy.—Externally, the recent leaves have been used, rubbed up with ointment, as a stimulating antiseptic dressing for ulcers and condylomata. A strong tincture may be applied externally, in warts and excrescences, and given internally in 0.30 c.cm. (or *m*v) doses. Four Gm. (or 3j) of thuja added to 30 c.cm. (or f3j) of warm water is said to constitute an excellent injection in hydrocele, the fluid having been previously withdrawn from the sac. In papillomata of various kinds Dr. Piffard speaks highly of it, and considers it useful in gleet dependent upon granular urethritis. The oil has been given with the view of expelling worms, but should be cautiously used, as it is a gastro-intestinal irritant. It has even brought on abortion in pregnant women, but only does so by the violent disturbance it creates in the gastro-intestinal tract. In bronchitis the vapor of thuja, steeped in boiling water, often increases expectoration, and has a secondary astringent effect.

Thuja has been used both internally and externally, with some success, in chronic rheumatism. In amenorrhœa and prostatitis it has been found of avail, and is said to have been serviceable in intermittent fever. This remedy seems to exert a certain influence upon the growth of malignant tumors, and has been thought to have a special power in restraining the hæmorrhage which they occasion. It has also been employed in hæmoptysis.

The **Oil of Pumilio Pine,** from an allied species, has been used in 4 c.cm. (or f3j) doses, given in milk, as a tæniacide. It is pleasant, effective, and apparently a safe remedy.

THUS AMERICANUM (B. P.) is identical with Terebinthina (U. S. P.). (See page 881.)

The concrete oleoresin, which is scraped off the trunks of Pinus palustris and Pinus Tæda, when fresh, is of a rather soft, pale-yellow color. It is an opaque, tough solid, with a terebinthinate odor. On keeping it becomes dry,

[1] The Cupressus thyoides, an entirely different tree, is also known by the name of white cedar, and more appropriately.

brittle, translucent, darker in color, and fainter in odor. It is a crude, white turpentine from two American varieties of the pine: the long-leaved pine and the lob-lolly, or old field pine of the Southern States. As its medicinal uses depend upon the volatile oil, its physiological action and therapeutic applications have already been considered under the heading **Terebinthina.**

THYMOLIS IODIDUM (U. S. P.).—**Thymol Iodide,** or aristol, is made by adding a solution of iodine in potassium iodide to an aqueous solution of sodium hydrate containing thymol, when it is thrown down as an abundant, red-brown, amorphous precipitate. In the reaction an iodine atom is substituted in hydroxyl. The proportion of iodine present in aristol has been estimated by Carius at 45.80 per cent. It is dithymol diiodide ($C_{20}H_{24}O_2I_2$).

Aristol is insoluble in water and glycerin, slightly soluble in alcohol, but readily so in ether. The addition of alcohol precipitates it from its ethereal solution. It is very soluble in chloroform and oils, but the solution must be made by friction without the aid of heat, since aristol is decomposed by the action of heat or of light. The character of its chemical combination renders it an unstable compound. Aristol is decomposed in contact with ammonia, alkalies and carbonates, corrosive sublimate, metallic oxides, and starch. It possesses but a slight odor, which agreeably recalls that of thymol. In this respect it is decidedly preferable to iodoform.

Physiological Action.—Aristol adheres very readily to the skin, and is, therefore, well adapted for use as a dusting-powder. It is free from irritant action upon the unbroken skin. Applied to the mucous membrane, it promotes secretion. It is not absorbed, either through mucous membranes or raw surfaces, and therefore produces no toxic effect. It has been given internally by Neisser with no appreciable result. This experimenter found that, when dissolved in suitable menstrua and injected into the blood, it became decomposed and iodine appeared in the urine.

The absence of disagreeable odor and its freedom from toxic influence are features which give aristol a great advantage over iodoform, and, from the evidence now before us and continually accumulating, it seems probable that in a wide range of conditions it may eventually supplant the latter substance, especially since it has been admitted to the pharmacopœia.

Therapy.—The attention of the profession was first drawn to aristol by Dr. Eichhoff, of Elberfeld, who warmly commended its local action in a number of affections. His experiments have been confirmed by various observers, both in Europe and America.

Aristol is remarkably efficacious in promoting rapid cicatrization. Varicose ulcers of the leg, so common in the old or decrepit, heal very quickly under the application of an ointment containing 10 per cent. of aristol. A 5-per-cent. ointment proved equally efficacious in the case of open buboes. In lupus ulcers a smooth, sound, and healthy scar is at times obtained by the use of aristol, either as a powder or in the form of an ointment. Eichhoff points out the fact, which was confirmed by the investigations of Neisser, that the remedy is ineffective in lupus which has not advanced to the ulcerative stage. The explanation is that aristol has no corrosive power. It is not capable of destroying or penetrating an intact cuticle, and therefore can exert no influence upon the cells of the lupus nodule. Its action is not upon lupus *as such,* but upon the ulcer which is the consequence of an advanced stage of the disease. Eichhoff in several cases anticipated the

result by the formation of an artificial ulcer by the use of the sharp spoon or Paquelin's cautery. In scrofuloderma excellent results have been obtained by the use of the remedy under discussion. Overhanging edges should be trimmed away, and if the granulations are flabby the base of the ulcer should be scraped before the aristol is applied. Vinal recommends a 20-per-cent. ointment of aristol in the treatment of fissured nipples during lactation.

Upon the ulcers of late secondary, or tertiary, syphilis, this remdy exhibits a remarkable influence. Eichhoff, indeed, expressly asserts that as a local application in tertiary syphilis it is superior to any other agent. It is of equal value in the ulcers of the congenital form of the disease, and in the large, moist papules of hereditary or acquired syphilis. Another manifestation of this malady, which may be amenable to the influence of aristol, is ozæna. Within a few days the fœtor and discharge may disappear and scabs cease to form. Simple ozæna also is notably improved by the same treatment. The insufflation of aristol has been found beneficial in epistaxis. In dry rhinopharyngitis, atrophic rhinitis, and dry laryngitis the insufflation of aristol, with powdered starch, or milk-sugar, is of decided benefit.

The writer is by no means desirous of advocating injudicicusly and prematurely the virtues of any medicament, especially in reference to such a malign affection as cancer. But, from the testimony of excellent observers and from his own clinical experience, aristol appears to have a power not hitherto exhibited by other remedies: that of originating apparently healthy granulations and cicatrization of some cancerous ulcers. Eichhoff obtained a prompt cure of chancres of the penis and lips, but strangely enough saw no good effects from the use of aristol in chancroid. His experience as regards chancroid has been corroborated by Neisser. It is reported that this drug is very good in ulcers of the cornea, in an ointment of 0.065 to 0.13 Gm. to 4 Gm. (or gr. i-ii to 3j) of lanolin and benzoinated lard. He has derived great benefit from it in pure powder on the ulcers of the lid and brow; it causes such to heal up very quickly. It acts, he adds, like iodoform, and has not such a very penetrating and unpleasant odor.

Dr. James Wallace has employed aristol powder with success for the purpose of clearing up corneal opacities in the chronic stage of interstitial keratitis. This substance is likewise an excellent and prompt antiseptic. In tinea tonsurans and tinea sycosis it generally proves efficient in the form of an ointment containing from 5 to 10 per cent. In favus, however, it is of little or no avail. In balanoposthitis, after the preputial sac has been thoroughly cleansed, the application of aristol in the form of a dusting-powder is of decided service.

Eichhoff, Lassar, Gaudin, Neisser, and others have witnessed decided improvement from the use of this agent in psoriasis. The author has found it at least as beneficial as chrysarobin, while, unlike the latter, it does not stain the skin and clothing, and is free from the danger of exciting conjunctivitis. In eczema squamosum, likewise, notable amendment has attended its use. It serves a good purpose also in erysipelas. Rohrer has employed aristol by insufflation, with very satisfactory results, in subacute and acute inflammation of the middle ear. The discharge speedily diminished, the mucous membrane became smooth, and the perforations healed. Inflammation of the external ear was also very amenable to its influence. Guerra y Estape obtained excellent results in twenty cases of disease among children, to whom iodoform is so repugnant, and, in fact, dangerous. An

extensive ulcer over the parotid gland healed in seven days, a chronic coryza in six days, and in the case of an unhealthy ulcer over the thorax suppuration ceased in twenty-four hours and cicatrization soon began. No ill effects were seen in any of the cases. Pollack, of Prague, has found aristol to possess marked sorbifacient virtues. An enlarged thyroid gland was perceptibly decreased in less than two weeks and soon afterward the neck was quite normal in size. In epididymitis, chronic tubercular adenitis of the neck, parametritis, and typhlitis equal success attended the use of the remedy.

The author[1] has made use of aristol with advantage in hyperidrosis and bromidrosis, either prescribed alone as a dusting-powder or combined with boric acid. It restrains profuse secretion and overcomes offensive odor. An ointment containing 2 Gm. (or gr. xxx) of aristol to the ounce of excipient is serviceable in acne and rosacea. Dr. Kejzlar has employed aristol in dentistry on account of its antiseptic properties in gangrenous pulps, in disinfecting the root-canals and carious cavities, before introducing the filling, etc. On gangrenous pulps, he dusted aristol by means of a fine brush; for cleansing the canals and cavities he used a 10-per-cent. solution in ether. The ether evaporates, and the aristol is left in the cavity as a uniform coating. In chronic dysentery, Dr. B. M. Randall, of Graceville, Minn., derived satisfactory results from the use, three times daily, of a suppository containing 0.20 Gm. (or gr. iij) of aristol and 0.02 Gm. (or gr. $^1/_3$) of morphine.

At the Hôpital Saint-Louis, in Paris, an aristol plaster has been used. The following is the method of its preparation: Finely-powdered aristol is mixed with a small quantity of oil, and to the mass is added lanolin and caoutchouc plaster, previously cooled and made very fluid by the addition of benzin. The benzin is sufficiently evaporated to leave a preparation suitable for spreading upon muslin. An aristol gauze has lately been brought into use as an antiseptic dressing. It is made by impregnating gauze with an ethereal solution, and contains from 1 to 2 Gm. (or gr. xv-xxx) per square yard.

The following formulæ containing aristol will be found of great service:—

℞ Thymolis iodidi
Pulv. zinci carb. impur. ..... aa 15|5 Gm. or ʒss.

M. Sig.: Dust over the surface. Employ as a dressing to wounds; also, in excessive sweating and oily state of the skin.

℞ Thymolis iodidi ..... 2| Gm. or 3ss.
Ungt. zinci oxidi,
Ungt. plumbi subacetatis ..... aa 15|5 Gm. or ʒss.

M. Sig.: Apply well to the surface. Beneficial in infantile and chronic eczema and in psoriasis.

℞ Thymolis iodidi ..... 3|25 Gm. or gr. l.
Ext. belladonnæ folior. ..... |17 Gm. or gr. iiss.
Ol. theobromatis ..... q. s.

M. et ft. suppos. no. x.
Sig.: Insert one in the bowel when necessary, to relieve pain. For cystitis and prostatitis.

Dr. Brooke has employed aristol internally with decided advantage in the summer diarrhœa of children, typhoid fever, in simple and complicated diarrhœas, and dysentery. He regards it as valuable in cases of offensive and

[1] See paper on "Aristol" in the *Medical Bulletin*, June, 1891.

bloody muco-purulent discharges from the bowel. He gave it in doses of 0.32 Gm. (or gr. v) to the adult and in proportional doses to children according to age.

Iodonaphthol.—This name has been bestowed by W. Braille upon a new body, analogous to aristol, prepared by adding an aqueous solution of iodine and potassium iodide to a solution containing betanaphthol and potassium hydrate. To this mixture is gradually added a solution of sodium hypochlorite containing ten times its volume of combined chlorine. The new body occurs in the form of a greenish-yellow pulverulent precipitate, which is odorless and tasteless, insoluble in water, partially soluble in alcohol and acetic acid. It soon darkens upon exposure to light.

THYMUS.—Thyme.

Preparations.

Oleum Thymi (U. S. P.).—Oil of Thyme (principally used externally). Dose, 0.06 to 0.12 c.cm. (or *mi*-ij).

Thymol (U. S. P., B. P.).—Thymol ($C_{10}H_{14}O$). Dose, 0.03 to 0.13 Gm. (or gr. ss-ij).

Pharmacology. — The Thymus vulgaris (Labiatæ), or thyme, is indigenous to Europe, but cultivated in gardens as an herb. The **volatile oil** is official (U. S. P.); it has a strong odor, a characteristic pungent taste, a neutral reaction. It consists of two portions, the lighter and more volatile being the hydrocarbons **Cymene** and **Thymene**, the second being chiefly **Thymol**, which is a phenol. It should be quite free from carbolic acid, with which it might be adulterated. Thymol is also obtained from the volatile oils of Monarda punctata and Carum Ajowan (U. S. P.); from the volatile oils of Monarda punctata and Carum copticum in addition to Thymus vulgaris (B. P.). It crystallizes in hexagonal forms, nearly or quite colorless; the crystals, when rubbed, develop electricity and attract small pieces of paper, and has lately been obtained by two Japanese chemists from the oil of Mosula japonica, a labiate plant.

Thymol has an aromatic, thyme-like odor; a pungent, aromatic taste, with very slight caustic effects upon the lips, and a neutral reaction. It liquefies with camphor. It is soluble in about 1200 parts of water and 900 of boiling water; freely soluble in alcohol, ether, chloroform, benzin, glacial acetic acid, and oils.

Physiological Action.—In its effects, the oil of thyme is very much like the oil of peppermint or origanum, and, in fact, is often commercially substituted for the latter. **Thymol** is a valuable antiseptic; it is less powerful than carbolic acid, but, on the other hand, is ten times less poisonous and much less caustic and irritating.

Thymol paralyzes the end-organs of sensory nerves in the skin and mucous membranes, but is a local irritant, and cannot be used well for the purposes to which cocaine is applied. It is a powerful antiseptic and disinfectant. Internally, in doses of 1.30 to 2 Gm. (or gr. xx-xxx) *per diem*, it causes epigastric heat, sweating, ringing in the ears and deafness, and it escapes chiefly by the urine, which is increased, and becomes olive-greenish in color as after carbolic-acid poisoning. It lowers arterial tension and reflex action, reduces the temperature, and may cause fatal coma. The nerve-centres of the cord are paralyzed by large doses.

Therapy.—Volkman and other surgeons have utilized thymol in antiseptic dressings as a substitute for the more toxic and less agreeable carbolic acid. It has been found a good application in eczema, psoriasis, and ringworm. An ointment containing 0.65 Gm. to 31 Gm. (or gr. x-℥j) of thymol is of service in acne and alopecia circumscripta. The addition of a little alcohol renders it possible to prepare a 1-to-1000 watery solution, which is efficient, and sometimes even needs to be weakened. A thymol solution is a useful injection in leucorrhœa. Thymol has been used both locally and internally, with success, in diphtheria. In solution it has been inhaled with benefit in laryngitis, and in phthisis it disinfects the sputum. In catarrh of the upper air-passages, Dr. Clarence Rice recommends inhalations of the following mixture:—

℞ Menthol.,
Thymol.,
Phenol liquefact. ..... aa | 32 Gm. or gr. v.
Ol. eucalypti ..... 60 | c.cm. or f℥ij.
Ol. pini pumilio. ..... 90 | c.cm. or f℥iij.

M. A teaspoonful is added to boiling water and the steam inhaled or 20 or 30 drops are placed upon a sponge or piece of cotton.

Thymol has also been administered internally in phthisis. It may be inhaled with advantage in bronchitis, whooping-cough, and gangrene of the lung.

Kuessner reported good results from the internal use of thymol in diabetes, vesical catarrh, and infantile diarrhœa. Bufalini states that thymol, given in conjunction with a nitrogenous diet, restrains glycosuria, but is without effect when the patient is upon a mixed diet. Surgeon-Major Lawrie has reported two cases of chyluria of filarious origin successfully treated by means of 0.065 Gm. (or gr. j) of thymol every four hours, increased gradually to 0.32 Gm. (or gr. v). A modification of this method consists in the association of gallic acid and thymol. Nugent has reported a case of chyluria, in which the presence of the filaria was demonstrated in the urine, treated with success by means of 1 Gm. (or gr. xv) of gallic acid and 0.13 Gm. (or gr. ij) of thymol thrice daily, the quantities being increased to 1.30 Gm. (or gr. xx) of the former and 0.32 Gm. (or gr. v) of the latter remedy. Rapid improvement took place, the urine became normal at the end of two weeks.

Thymol has been employed with advantage in dentistry by Hartmann, of Münster. He applies it for the destruction of the tooth-pulp, and also in acute pulpitis. Glycerin is a good vehicle, and, when diluted, a glycerite of thymol makes a good mouth-wash. In acute and chronic intestinal disorders, thymol has been employed by a number of clinical observers. Dr. Frederick P. Henry has used thymol, prepared with Castile soap, in 0.13 to 0.20 Gm. (or gr. ii-iij) doses every six hours. He reports that, in typhoid fever, the temperature falls, the stools become less frequent, cerebral symptoms diminish, and the tongue cleans off and becomes moist. Testi has employed thymol in one hundred and fifty cases of typhoid. He says that the drug lowers temperature, diminishes tympanites, hinders fermentative processes in the intestinal tract, reduces the excretion of the urea, and increases the blood-pressure, without injury to the heart. Thymol has also been given internally in articular rheumatism.

Campi has used thymol with success as a tæniacide, according to the following method: 18.5 to 22 c.cm. (or f℥v-vj) of castor-oil are given at bed-

time, and the next morning, beginning early, 0.65 Gm. (or gr. x) of thymol are given every fifteen minutes. The worm is said to be expelled entire.[1] Dr. Sonsino, of Pisa, has never witnessed any good results from the use of thymol as a tæniacide, but states that it is of avail in cases of ascaris lumbricoides and especially oxyuris vermicularis. In the latter he administers it by enema. Combined with lime water and linseed oil it is recommended as an application of value in the treatment of burns, especially in children.

Thymol Carbonate, or **Thymotal,** is a white crystalline substance, with very little odor. It is not affected by acids or by the contents of the stomach. It has been recommended by J. E. Pool as a vermifuge in doses of 2 Gm. (or gr. xxx) for adults, or 0.50 Gm. (or gr. viiss) for infants, three or four times daily, for four days, followed by a purgative taken on the fifth day.

Thymacetin.—Hoffmann, of Leipzig, has prepared this substance, which bears the same relation to thymol as phenacetin to phenol. Thymacetin is a white, crystalline powder, slightly soluble in water, readily soluble in alcohol, and sparingly in ether. It melts at 136° C. (276.8° F.). It has been given to dogs in doses of 2 Gm. (or gr. xxx) without causing symptoms of intoxication. In many cases it causes slight headache lasting for several hours. It increases arterial tension and pulse-rate. In certain instances it gives rise to digestive disorder and gastric catarrh. Jolly has experimented clinically with this product in a number of cases. It was without effect in true migraine, but in other cases of headache proved equal to phenacetin. It induced sleep in sixteen out of twenty-six cases of insomnia, the average dose necessary being 0.50 Gm. (or gr. viiss).[2]

Thymus serpyllum, or wild thyme, is very highly recommended by Dr. Sidney B. Straley, of Andover, N. J., in the treatment of whooping-cough. To this observer it appears to have almost a specific action. A tincture of the green plant is harmless in doses as large as ½ c.cm. (or f3j) to a child of eight years. The remedy is efficient in any stage of the disease; its action is fully established in twenty-four hours and completed in five days.[3]

THYROIDEUM SICCUM (B. P.). — **Dry Thyroid.** (See **Animal Extracts, Juices, and Secretions.**)

TILIA.—The dried inflorescence of the linden-tree of Europe (Tilia vulgaris, T. parviflora, and T. grandiflora; natural order, Tiliaceæ) has a faint, but pleasant, odor and sweetish taste. The flowers are popularly employed in making an infusion for bathing the forehead for headache, also an aromatic water, which is used as a vehicle, in France especially.

TONGA is a drug from the Fiji Islands, composed apparently of a mixture of several varieties of barks and roots, which are arranged in bundles. Drs. Ringer and Murrell, having made a series of experiments, which were reported in 1880, recommended it to the profession for further trial. It

[1] "Annual of the Universal Medical Sciences," 1890, vol. v, A-136.
[2] See *British Medical Journal*, March 19, 1892.
[3] *Medical Bulletin*, 1893, p. 190.

was supposed to be derived principally from the Raphidophora Vitiensis (Schott), a creeping plant of the order Araceæ, and Premna Taitensis (Schauer), a small tree of the natural order Verbenaceæ. A volatile alkaloid, **Tonghine**, has been isolated from the former; the latter contains some volatile oil.

Physiological Action.—Beyond slight drowsiness, Ringer and Murrell observed no systemic effects from 45 c.cm. (or f℥iss) of the fluid extract, given within three hours. The pupils and the secretion of the mouth and skin were unaffected. The sensibility of the skin supplied by the fifth nerve remained unaltered. They saw no influence upon the pupil from a topical application. Dr. C. Bader states that the alcoholic extract, dropped into a healthy eye, seemed to increase the power of accommodation, without affecting the size of the pupil. He remarked, however, that in some cases large doses, taken internally, caused great dilatation of both pupils. Dr. T. H. Streets, U.S.N., reports the experience of himself and several colleagues. They found a decided diminution in the excretion of urea from 30 c.cm. (or f℥j) doses, but no increase in the quantity of uric acid. The pulse, temperature, and pupils were unchanged. Two of the four experimenters noticed a tendency to cerebral congestion of short duration; one was slightly purged. The symptoms disappeared in about two hours, leaving no after-effects.

Therapy.—From the claims made by its introducers, it was thought that tonga would be a valuable addition to our list of antineuralgic remedies. In order that it should gain a secure position among remedies, it would be necessary to exercise supervision over the source of supply, so that it shall be of uniform strength and quality. Tonga is stated to be of marked service in the treatment of neuralgia, especially when it involves branches of the fifth nerve. It has relieved pain in a large majority of the cases in which it has been employed. The fluid extract should be given in 4 c.cm. (or f℥j) doses, and repeated at intervals of about two hours, while needed. Tonga is rather slow in its action, and it requires about two hours for the full effects of the drug to be manifested. Dr. Bader has seen good results from the local use of tonga in asthenopia, rheumatic iritis, and photophobia.

TRAGACANTHA (U. S. P., B. P.).—Tragacanth.

Preparations.

Mucilago Tragacanthæ (U. S. P., B. P.).—Mucilage of Tragacanth (6 per cent.).

Glycerinum Tragacanthæ (B. P.).—Glycerin of Tragacanth (tragacanth, 10 Gm.; glycerin, 30 c.cm.; and distilled water, 10 c.cm.).

Pulvis Tragacanthæ Compositus (B. P.).—Compound Powder of Tragacanth (tragacanth, gum acacia, starch, aa 25 Gm.; refined sugar, 75 Gm.). Dose, 1.30 to 4 Gm. (or gr. xx-℥j).

Pharmacology.—Gum tragacanth is the product of trees growing in Asia Minor and Persia. It is "a gummy exudation from Astragalus gummifer, or from other species of Astragalus (Leguminosæ)." It is in white, flattened bands, which, in drying, become curled or twisted, and are afterward broken in small pieces. It is horn-like, or translucent; and, when moistened with water, it is converted into a gelatinous mass. The soluble gum is not identical with **Arabin**, but resembles it; the insoluble portion consists of **Bassorin**, **Traganthin**, and **Adraganthin**, and a little starch. Traga-

canth paste is adhesive, and is used in practical pharmacy to paste labels on bottles, boxes, etc. It is also the basis of most of the United States Pharmacopœia official troches, and is of service in emulsions for the suspension and diversion of various powdered drugs, and for codliver-oil, and as a pill basis.

Therapy. — Only used in medicine, other than already stated, as a demulcent in pharyngitis, gastritis, and inflammation of the bowels. Large amounts do not agree with the stomach, unless some antiseptic agent, like creosote or naphthol, is administered at the same time, to prevent fermentation. It contains a little starch, and has slight nutritive properties.

Dr. George T. Eliot, of New York, has introduced bassorin as a base for the application of medicaments to the integument. Bassorin is a demulcent substance, tasteless and odorless, converted into a viscous mass by the addition of hot water. When mixed with water, glycerin, and dextrin, a bassorin paste is obtained, of jelly-like consistence and light-yellow color. This paste is neutral, undergoes no alteration, does not stain the skin or clothing, adapts itself perfectly to the affected surface, and may be readily removed at any time by the aid of water. Solid substances can be incorporated with bassorin paste in any desired proportion. Fluid preparations render it too liquid, while alcoholic solutions cause it to become hard and brittle.

M. Vindevogel recommends that, in preparing ointments containing large proportions of extracts or salts, 2 Gm. (or ʒss) of powdered gum tragacanth be added for each cubic centimetre of the water employed in dissolving the salt or extract. The fatty body is added after trituration, and by this method a homogeneous ointment of good consistence is made. If absorption of the unguent is desired, the bassorin of the gum proves a disadvantage.

TRIFOLIUM PRATENSE. — The flower-heads of red clover, or Trifolium pratense (Leguminosæ), are fragrant and sweetish, containing a flavoring principle and sugar. The fluid extract and infusion are both employed.

Physiological Action.—It is considered diuretic and alterative.

Therapy. — The infusion of clover-tops is given to children suffering with whooping-cough, with good results. The fluid extract, containing alcohol, is employed externally in domestic practice for wounds and ulcers. A compound syrup of red clover, containing red clover, 2.10 Gm. (or gr. xxxij); stillingia, 1 Gm. (or gr. xvj); berberis aquifolium, 1 Gm. (or gr. xvj); prickly-ash bark, 0.25 Gm. (or gr. iv); burdock-root, 1 Gm. (or gr. xvj); poke-root, 1 Gm. (or gr. xvj); cascara amarga, 1 Gm. (or gr. xvj); potassium iodide, 0.50 Gm. (or gr. viij), in each 30 c.cm. (or f℥j) of the syrup, has been furnished. It is useful as an alterative in syphilis, struma, and some chronic forms of skin disease. It is also supplied without containing the iodide.

TRIKRESOL. (See **Cresol.**)

TRILLIUM.—The Trillium erectum (Liliaceæ), beth-root, growing in woody places in the northern United States, contains in its rhizome **Saponin**, a little volatile oil, tannin, resinous and fatty matters, with much starch, and some coloring matters. The dose of the fluid extract (N. P.) is 4 to 7.50 c.cm. (or f℥i-ij).

Physiological Action.—It is astringent, tonic, and antiseptic.

Therapy. — In genito-urinary affections, hæmaturia, and pulmonary affections trillium is used in the form of a fluid extract, which is also used externally for wounds. It is an ingredient in the compound fluid extract of stillingia (see page 851).

TRIMETHYLAMINI HYDROCHLORAS. — Trimethylamin, with dimethylamin and tetramethylammonium hydrate, are compound ammonia bodies, discovered by Hoffmann. Dimethylamin is a combustible gas. Trimethylamin is also a gas at ordinary temperatures, with a strong ammoniacal odor and an intense alkaline reaction; with methyl iodide it forms a salt which, being treated, in solution, with silver oxide, yields silver iodide and tetramethylammonium hydrate. The latter body, being subjected to dry distillation, decomposes into trimethylamin and methyl alcohol. Trimethylamin [$(CH_3)_3N$] exists already formed in Arnica montana, Chenopodium vulgaris, in the flowers of Cratægus oxyacantha, in ergot, in codliver-oil, and in various decomposing albuminous compounds, particularly herring-brine, guano, urine, and coal-gas tar. Vincent extracted large quantities from the residue of the distillation of fermented beet-juice, or the refuse left after making beet-sugar. Propylamin is usually an impure trimethylamin in solution; the name properly belongs to another, though similar, compound.

Physiological Action.—Trimethylamin hydrochlorate, in strong solution, acts as a caustic; when applied to the lip it causes a burning sensation, and the epithelium afterward exfoliates, leaving a superficial ulcer. Internally, it acts as an irritant to the digestive tract, and to its local action Dujardin-Beaumetz ascribes the cause of the fatal result from a large dose; he states, however, that as much as 5 Gm. (or gr. lxxv) may be given without fatal effect. Doses of about 1.30 Gm. (or gr. xx), repeated several times, cause, in rabbits, general distress, tremor, with loss of motive power, hyperæsthesia, and increased reflex excitability; the same amount injected under the skin produces death. In the human subject the first effect, from moderate doses, is increase of the heart's action, but soon, especially if full doses are given, the opposite condition is set up: the pulse-rate and temperature are lowered. No colic or diarrhœa occurs, but the odor and taste are so unpleasant that the remedy is often rejected by the stomach. No increase of perspiration or of the urine is reported.

Combemale and Brunelle state that trimethylamin provokes an excessive secretion of saliva and increases the alkalinity of that fluid. The nasal and lacrymal secretions are augmented and a slight albuminuria is produced. Dujardin-Beaumetz states that the excretion of urea is diminished by the drug. Fatal narcosis may occur from retention of carbonic-acid gas in the blood, but Phillips ascribes death more commonly to the depressing effects of the remedy upon the spinal cord.

Antidotes to Toxic Action.—The proper treatment of poisoning would be by external heat, and counter-irritation by mustard or turpentine, and opium and belladonna or atropine to control the symptoms. The tincture of capsicum, with digitalis, strophanthus, or nux vomica, would be useful in counteracting the effects upon the circulation.

Therapy.—This drug was introduced for the purpose of treating acute rheumatism, and in cases with high temperature and active circulation it has produced good effects. It has also been used as an antipyretic in other maladies, in doses of 0.13 Gm. (or gr. ij) repeated every three or four hours.

It should be given in capsules or in solution with peppermint-water, well diluted. Trimethylamin is of service sometimes in chronic rheumatism, in which it has been also used as a liniment, 1 part being mixed with 3 parts of glycerin. It has been administered in gout.

TRIONAL. (See **Sulphonethylmethane.**)

TRITICI FARINA. — Wheat-flour. The Triticum vulgare (Graminaceæ), or wheat, is a well-known source of food. The farina is a fine, white flour, prepared from the seed; it is impalpable, inodorous, and of insipid taste. It consists of starch, 70 per cent.; gluten, 12 per cent.; fixed oil, 2 per cent.; together with cellulose, sugar, and water. It yields about 2 per cent. of ash, containing 50 per cent. phosphoric acid. It is highly nutritious, and contains a large amount of nitrogenous matters. With cold water, it forms a granular, pasty mass, not very adhesive; but, with hot water, the starch-granules swell up and burst, making a homogeneous, jelly-like mixture.

Physiological Action.—It is bland and unirritating, and forms a good antidote, when mixed with water, in case of corrosive poisoning. The starch is antidotal to iodine and its preparations.

Therapy.—Wheat-flour dusted upon an inflamed surface coats it over with a layer which protects it from the air. It is a convenient application to recent burns and scalds, or erysipelas; but in hot weather it should be associated with some antiseptic to prevent the development of insects, the ova or larvæ of which very often find their way into flour, especially if exposed to the air. It has been asserted that a tablespoonful of flour, in a glass of cold water, swallowed night and morning, will check the development of boils. As the basis of bread, wheat-flour enters into the question of nourishment for the sick, which belongs more to the province of the nurse than the physician, although the medical attendant should be perfectly familiar with the digestive and nourishing qualities of any preparation which may be submitted to his judgment, in order to pronounce upon its fitness, or the reverse, for the patient.

TRITICUM (U. S. P.).—**Couch-grass.**
Dose, 4 to 15.5 Gm. (or 3i-iv), in infusion or fluid extract.

Preparation.

Fluidextractum Tritici (U. S. P.).—Fluid Extract of Triticum. Dose, 2 to 7.5 c.cm. (or f3ss-ij).

Pharmacology.—The dried rhizome of Agropyrum repens (Gramineæ), gathered in the spring, and deprived of its roots. It is a common, naturalized perennial, a native of Europe and Asia; everywhere growing in the fields, and regarded as a weed. The rhizome contains **Triticin,** a nitrogenous gum, sugar (both dextrose and levulose), but is devoid of starch and resin.

Physiological Action.—It is demulcent and diuretic.

Therapy.—Triticum may be given, in decoction, as a demulcent drink in fevers. This preparation, or the fluid extract, is useful in irritability of the bladder and chronic cystitis. In the latter affection, Sir Henry Thompson recommends a pint of the infusion or decoction, to be taken during the

day. In chronic cystitis, irritable prostate, and in gleet, the writer has prescribed the following with triticum:—

℞ Fluidext. tritici	90		c.cm. or f℥iij.
Tinct. belladonnæ fol.	4	6	c.cm. or *m*lxxij.
Sodii bicarbonatis	8		Gm. or ʒij.

M. Sig.: A teaspoonful in water every two or three hours.

The following combination relieves irritable bladder or cystitis in women:—

℞ Potassii citratis	15	5	Gm. or ℥ss.
Fluidext. tritici	30		c.cm. or f℥j.
Tinct. belladonnæ fol.	9	25	c.cm. or f℥iiss.
Fluidext. buchu	15		c.cm. or f℥ss.
Aquæ	q. s. ad 120		c.cm. or f℥iv.

M. et ft. sol.

Sig.: Teaspoonful in a wineglassful of water three times a day.

Tincture of hyoscyamus may be substituted for the tincture of belladonna in this formula.

The fluid extract is a pleasant, malt-like preparation, has some nutritive properties, and possibly may be of value in chronic bronchial disorders. The decoction is one of the many popular remedies for consumption.

TROPACOCAINE.—This is an alkaloid which has been obtained by Giesel from the small-leaved coca-plant of Java. Liebermann has determined that in chemical composition it is benzoyl-pseudotropein, and regards the pseudotropein, which he has succeeded in separating, as identical with the substance of that name derived from Hyoscyamus niger. For the sake of convenience the name tropacocaine has been adopted. Liebermann has succeeded in preparing it by synthesis. Although closely related chemically to the solanaceous alkaloids, its physiological and therapeutical properties closely resemble those of cocaine.

Physiological Action.—The physiological effects of tropacocaine were first investigated by Dr. Arthur P. Chadbourne, of Boston, who found that in the frog the difference of action between tropacocaine and cocaine is chiefly quantitative. In rabbits repeated small doses caused cerebral stimulation, followed by a quiet interval. After this stage, inco-ordination and convulsions ensued. When larger doses were given, the convulsive stage was short and was rapidly succeeded by coma, failure of respiration, and death. Small doses at first increase the pulse-rate, but there is, in general, no considerable temporary rise like that usually produced by cocaine. The increase is followed by decrease of pulse-rate and a gradual, but steady, fall of blood-pressure. Injection into the jugular vein, more or less completely paralyzes the motor ganglia in the heart and quickly lowers the tonus of the peripheral vessels. Tropacocaine produces complete local anæsthesia more rapidly than cocaine, and, as a rule, the effect is more lasting. Tropacocaine has but half the toxicity of cocaine. Although classified by Liebermann with the atropine group, tropacocaine does not dilate the pupil. It may be substituted for cocaine in equal doses. The solutions keep unchanged for months.

A number of experiments were performed by Dr. Hugenschmidt, of Paris, upon human subjects. The injection of 2 cg. (or gr. $^1/_3$) into the gum slightly quickened the action of the heart without affecting arterial tension. There was slight dryness of the throat, but no dilatation of the pupil. The

injection of double the quantity caused vertigo and a sudden fall of blood-pressure. The respiration was uninfluenced and the normal pulse-rate was soon regained.

Therapeutics.—Tropacocaine was first employed therapeutically in the ophthalmological clinic of Professor Schweigger. Both the physiological and therapeutical investigations were carried on with a synthetically prepared tropacocaine hydrochloride. The alkaloid derived from the plant causes considerable irritation, but this effect is not produced by the synthetically formed product. Ocular anæsthesia is more rapidly developed than by cocaine, and, although of shorter duration than that due to the latter alkaloid, may easily be maintained by adding a drop of the solution from time to time. It has been used in the form of a 3-per-cent. solution. On account of the rapidity of its action, it is particularly adapted for the removal of foreign bodies from the cornea. Tenotomy and iridectomy, also, are satisfactorily performed under its influence. Tropacocaine has been advantageously used in order to prevent pain from caustic applications to the lids, in dividing strictures of the lacrymal duct, and opening Meibomian cysts. In dental practice, Dr. Hugenschmidt has made use of solutions of tropacocaine and has extracted roots, broken up the alveolus, and removed a bony sequestrum without causing the patient any pain. Seifert has reported, concerning the application of tropacocaine to nasal and laryngeal surgery, that stronger solutions are required than are necessary in the case of cocaine. He adds that severe hæmorrhage is apt to follow the employment of tropacocaine.

Dr. Willy Meyer[1] refers to Schwarz's experience in producing spinal anæsthesia; the latter found that 0.05 Gm. (or gr. $^5/_6$) produced as perfect an analgesia as cocaine without any of its frequent symptoms, such as pallor, perspiration, vomiting, headache, and rise of temperature. Ten minutes after the injection analgesia was usually complete, and lasted until the end of the operation. He is not sure, though, that it can be sterilized by boiling without impairing its efficacy. Dr. Kuykendall, in producing spinal anæsthesia, places 0.06 Gm. (or gr. j) of tropacocaine in the barrel of the syringe before introducing the needle into the spinal canal. The spinal fluid flows into the syringe and dissolves the tropacocaine, which is now cautiously injected.

Tropacocaine possesses antiseptic properties, its solutions keep well, and it has the advantage of producing anæsthesia of inflamed tissues. It is claimed that it does not occasion any haze upon the cornea.

TUBERCULIN.—On November 14, 1890, Koch, of Berlin, announced, through the columns of the *Deutsche medicinische Wochenschrift*, that he had separated a substance, "tuberculin," from the products of tubercle bacilli which had a "specific" action in the treatment of tuberculosis. Although the subsequent results obtained by the profession were not as satisfactory as the first announcements led us to believe, yet it was, at any rate, a step forward in an entirely new field of treatment for this disease. The dose of tuberculin was 0.1 mgm. injected under the skin, and increased 0.1 mgm. every day. When injected into men or animals, who are the subjects of tuberculosis, it produces a great rise of temperature, while similar small

[1] *Medical News*, April 13, 1901.

doses injected into healthy individuals produce no rise of temperature. Among the other symptoms noted were pain in limbs, fatigue, some cough, and dyspnœa; at the site of the injection abscesses were also prone to develop. Koch, in 1897, contributed a second paper on a product which he termed, on account of its being an alkaline extract, TA (tuberculin); this produces a similar reaction as the original tuberculin, only that of the TA is more marked and of longer duration.

Finally, Koch described an elaborate process for making a purer extract than his former ones; from this process he obtained two extracts—TO and TR. The former (TO) does not produce abscesses at the point of injection; otherwise its action is similar to TA and the original tuberculin; with the TR preparation Koch claimed that, beginning with small doses and gradually increasing, animals could be immuned to the TR preparation and finally to the tubercle bacillus itself.

Tuberculin as a diagnostic agent is of some importance. Its value as a diagnostic agent of tuberculosis in cattle has been abundantly proved in recent years, a striking example being in the herd at Windsor, England.[1] It has been successfully used for this purpose in the human subject also. Dr. Max Beck[2] gives the details of 2137 cases which had been injected. In 1154, or 54 per cent., the diagnosis was made by means of the tuberculin injections. He states that, whenever a patient is found to react, a tuberculous focus, even though it may be small, must surely be assumed as being located somewhere, either in the bronchial glands, lungs, or other organs.

Prof. J. M. Anders[3] gives a table of 1470 suspicious cases of tuberculosis with 71.89 per cent. reactions. He advocates its use in all suspicious (incipient) cases in moderate doses, usually in doses from 2 to 5 mgm.

Virchow[4] early noted that tuberculin occasioned collateral hyperæmia, softening of the tubercles, and liberation of the tubercle bacilli from tubercles in the progress of recovery; this condition is likely to follow massive doses, which were used for their supposed therapeutic properties; but, in suspected cases where the known means of making a diagnosis fail, this agent may be tried, for at this period massive doses are not required. The therapeutic use of tuberculin is still in the experimental stage, as the reports of results are conflicting.

TUMENOL. — This is the name given to a substance derived from mineral oils, its title pointing to its origin from bitumen and oleum. The impure mother-substance occurs among the unsaturated hydrocarbons of the oils, and is separated by the addition of sulphuric acid, a process of sulphonation taking place, with the production of a compound consisting of tumenol-sulphon and tumenol-sulphonic acid. Tumenol has been used clinically by Neisser in the form of powder, solution in sulphuric acid and alcohol, and as an ointment or plaster. It was found serviceable in acute eczema, burns, ulcers, and paræsthesia, used externally (in 5- to 10-per-cent. solution). **Sodium-tumenol-sulphate** is a dark-colored, dry powder, is soluble in water, and is used for the same purposes as tumenol.

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[1] *London Lancet*, vol. i for 1899, p. 1041.
[2] *Deutsche medicinische Wochenschrift*, vol. xxv, p. 137.
[3] *New York Medical Journal*, June 23, 1900, p. 996.
[4] *Deutsche medicinische Wochenschrift*, 1891, p. 131.

TUSSILAGO.—Tussilago, Colt's-foot. The leaves and root of Tussilago farfara (Compositæ), growing in cold, clayey banks, in the Northern and Middle States, contain mucilage, tannin, and a bitter extractive.

Physiological Action.—Tussilago is demulcent, tonic, and, as the name indicates, it is also deemed expectorant or pectoral.

Therapy.—In cough attending chronic pulmonary affections, chronic bronchitis, etc., colt's-foot is used, often in combination with licorice, or hoarhound. The fresh leaves are applied in the form of a poultice to scorfulous ulcers. The fluid extract is a stomachic, and has some tonic properties, owing chiefly to the alcohol which it contains. Dose, 4 to 7.5 c.cm. (or f℥i-ij).

ULMUS (U. S. P.).—**Elm (Slippery-elm).**

Preparation.

Mucilago Ulmi (U. S. P.).—Mucilage of Elm (dried bark, 6 Gm.; boiling water, 100 c.cm.).

Pharmacology.—The "bark of Ulmus fulva (Ulmaceæ), deprived of its periderm." The red elm is a handsome forest-tree of North America, and its bark contains **mucilage** principally.

Physiological Action.—Elm-bark is used as a demulcent externally and internally. The dried bark, in flat pieces or strips, is sometimes chewed, as the taste is not unpleasant, and the mucilage moistens the mouth and throat.

Therapy.—Poultices of ground-elm bark, with lead-water, are serviceable in erysipelas and various forms of local inflammation; they are used cold or hot. Internally the mucilage may be given *ad libitum* in stomach and bowel disorders, and in painful affections of the urinary passages, dysuria, etc. Pieces of elm-bark, of suitable size and shape, may be made into tents for the dilatation of fistulæ, and in the treatment of uterine affections.

URETHANE.—(See **Æthylis Carbamas**, page 164).

UVA URSI (U. S. P.).—**Uva Ursi (Bearberry).**

UVÆ URSI FOLIA (B. P.).—**Bearberry-leaves.**

Dose, 4 to 8 Gm. (or ℥i-ij).

Preparations.

Fluidextractum Uvæ Ursi (U. S. P.).—Fluid Extract of Uva Ursi. Dose, 2 to 4 c.cm. (or f℥ss-j).

Infusum Uvæ Ursi (B. P.).—Infusion of Bearberry (5 per cent.). Dose, 15 to 30 c.cm. (or f℥ss-j).

Extractum Uvæ Ursi.—Extract of Uva Ursi. Dose, 0.32 to 1 Gm. (or gr. v-xv).

Pharmacology.—The dried leaves of Arctostaphylos Uva ursi (Ericaceæ), or bearberry, a small herb of North America and Europe, contain **tannic** and **gallic acids**, to which they owe their astringency. Three principles have been separated, **Arbutin**, **Ericolin**, and **Ursone**, the latter being tasteless, the others bitter and crystallizable, soluble in water and alcohol. The two former are glucosides; the latter appears to be a resin. There is also a small quantity of **Ercinol**, which is a volatile oil.

Physiological Action.—The preparations of uva ursi are astringent, and in proper dose carminative and tonic, but may constipate the bowels. The

astringent principles pass off by the kidneys and are sedative to the urinary passages. An overdose of uva ursi produces vomiting, purging, and genito-urinary irritation, with, sometimes, vesical tenesmus and hæmaturia.

Therapy.—The infusion or decoction of uva ursi is a valuable agent in treating irritation of the bladder, strangury, dysuria, pyelitis, or cystitis. It may be combined with an alkali as follows:—

℞ Sodii bicarbonat.	62	Gm. or ʒij.
Decocti uvæ ursi	240	c.cm. or fʒviij.

M. Sig.: Take a tablespoonful every two hours for vesical irritation, or in the strangury following the use of a blister.

Uva ursi has some reputation in calculous affections, gravel, etc. **Arbutin** is used in doses of 0.13 to 0.32 Gm. (or gr. ii-v) as a diuretic in dropsy, and also in urethritis. Arbutin appears to be devoid of toxic properties and communicates to the urine a greenish hue, which grows darker if the fluid is allowed to stand. This change of color seems to be due to a partial decomposition of arbutin into glucose and hydrochinone. The chemical change probably occurs in the kidneys. According to Lewin, arbutin is the active principle of uva ursi. Dr. Menche has given arbutin in daily doses of 0.75 Gm. (or gr. xij) with decided advantage in cystitis.

It has been asserted by Dr. Harris, of Alabama, that uva ursi causes uterine contractions, and can be used as a substitute for ergot, but further observations are needed to establish its value in this direction. Uva ursi has been given with success in leucorrhœa, menorrhagia, chronic dysentery, and bronchorrhœa, and is reported to have been beneficial in diabetes.

VACCINIUM VITIS IDÆA.—Vaccinium vitis idæa (Ericaceæ), mountain cranberry, or cowberry, is closely related to uva ursi. It grows in various European countries and in New England. It has a popular reputation as a remedy in rheumatism. An investigation of its properties has led two Russian physicians, Drs. T. Hermann and S. Smirnow, to conclude that the plant really possesses value in both acute and chronic articular rheumatism. It was given in the form of a decoction of the entire plant (8 to 15.5 Gm. to 180 c.cm., or ʒii-iv to fʒvj, of water), the entire quantity being taken in the course of the day.

Professor Winternitz, of Vienna, has successfully employed an extract of bilberry (Vaccinium myrtillus) in affections of the mouth, bronchi, kidneys, and bladder, and in diabetes. Dr. Weil, of Berlin, asserts that he has used it with advantage in the treatment of diabetes mellitus. A decoction of bilberry-fruit has been used with favorable effect as an injection in chronic gonorrhœa.

VALERIANA (U. S. P.).—**Valerian, Valerian-root.**

VALERIANÆ RHIZOMA (B. P.).—**Valerian Rhizome, or Root.**

Dose, 0.65 to 2 Gm. (or gr. x-xxx).

Preparations.

Fluidextractum Valerianæ (U. S. P.).—Fluid Extract of Valerian. Dose, 2 to 4 c.cm. (or fʒss-ij).

Tinctura Valerianæ (U. S. P.).—Tincture of Valerian (20 per cent.). Dose, 4 to 7.5 c.cm. (or fʒi-ij).

Tinctura Valerianæ Ammoniata (U. S. P., B. P.).—Ammoniated Tincture of Valerian (powdered valerian-root, 20; aromatic spirit of ammonia, to make 100 parts,

U. S. P. Valerian, 200 Gm.; oil of nutmeg, 3.1 c.cm.; oil of lemon, 2.1 c.cm.; solution of ammonia, 100 c.cm.; and alcohol [60 per cent.], 900 c.cm., B. P.). Dose, 4 to 7.5 c.cm. (or f3i-ij). B. P., 2 to 4 c.cm. (or f3ss-j).

The U. S. P. official valerianates are of ammonia, iron, quinine, and zinc; the latter is also official in the British Pharmacopœia.

Pharmacology.—"The dried rhizome and roots of Valeriana officinalis" (Valerianaceæ): a native of Europe, but cultivated in this country. The root contains a **volatile oil,** which was formerly official, and by oxidation yields **Valerianic acid.** When the drug is recently dried it contains more volatile oil and less valerianic acid; as it gets older, the oil decreases and the proportion of valerianic acid increases, while the odor becomes more marked. Valerianic acid is a colorless, oily fluid, with an odor resembling that of the drug, and a strongly acid and burning taste. It also contains **Valeren,** which is a terpine, and valerian camphor, with resin and water, constituting **Valerol,** which is changed by contact with air into valerianic acid. An alkaloid has been extracted from valerian-root by M. Waliszewski, of Clichy, and named **Chatinine** by its discoverer, in honor of M. Chatin, late Director of the School of Pharmacy of Paris. The same chemist has also isolated a second alkaloid termed **Valerine.** Valerianic acid may be made artificially by the oxidation of amylic alcohol, and it is from this acid that the valerianates are formed; but it does not quite correspond with the natural acid in its physiological effects. Borneol isovalerianate (or bornyval) is now claimed to be the active principle of valerian-root. The ammoniated tincture is a valuable preparation, owing to the stimulating and carminative effects of the ammonia. The effects of the valerianates made synthetically are inferior to that obtained from valerian-root. An elixir of ammonia valerianate, however, is an excellent preparation when well made, the odor and taste of the salt being covered by the addition of vanilla and a little chloroform; it contains 0.13 Gm. to 4 c.cm. (or gr. ii to the fluiddrachm), and is given in tablespoonful doses. In this preparation part of the result must be attributed to the alcohol which it contains.

Physiological Action.—Valerian is antispasmodic and slightly stimulating to the circulation. It reduces irritability and reflex contractions, and is a sedative to the spinal cord. In small quantities, valerian excites a sensation of warmth in the stomach, improves the appetite and digestion. Bouchard states that valerian materially decreases the amount of urea excreted. Large doses cause nausea and vomiting, diarrhœa, frequent micturition, tenesmus, increased discharge of urates, with giddiness, hallucinations, and mental disturbance, the oil being a paralyzing agent to the great nerve-centres. Elimination takes place through the kidneys, lungs, and skin.

Therapy.—There are no local applications, and the internal use has practically become limited to the treatment of nervous disorders in women, especially nervous headache and hysteria, or hystero-epilepsy. The following prescription, containing valerian, is serviceable:—

℞ Tinct. valerianæ ammon.,
Spiritus ætheris comp.,
Tinct. humuli ..... aa 60| c.cm. or f℥ij.

M. Sig.: Two teaspoonfuls in water, every hour or two.

The various nervous disturbances which occur at the menopause are relieved by the administration of valerian. This remedy is also of service in pruritus dependent upon disorder of the nervous system. Valerian is of advantage in allaying the nervous phenomena of exophthalmic goitre. Favorable reports have been made of its utility in diabetes insipidus and mellitus. The improvement, however, does not continue. In various spasmodic disorders in children, such as convulsions or chorea due to worms, nervous cough, whooping-cough, and in delirium with depression, it has been beneficially employed. The oil has been given to arouse patients from coma during the progress of a fever, like typhus. Morphine valerianate is sometimes used with the idea that it is better borne than the official salts. Zinc valerianate has been used in nervous diseases, chorea, epilepsy, and neuralgia, in doses of 0.13 to 0.20 Gm. (or gr. ii-iij), with considerable success.

VANILLA (U. S. P.).—**Vanilla.**

Preparation.

Tinctura Vanillæ (U. S. P.).—Tincture of Vanilla (10 per cent.), used for flavoring.

Vanillinum (U. S. P.). Vanillin.

Pharmacology.—Vanilla is the prepared, nearly ripe fruit of Vanilla planifolia (Orchidaceæ), a native of tropical America. The fruit appears in market in bundles of about fifty pods, six to ten inches long, dark-colored, one-celled, containing a blackish pulp, in which are imbedded numerous very small black seeds, and some crystals of the active principle **Vanillin.** The odorous, active principle is soluble in alcohol; the pulp also contains fixed oil, sugar, resin, etc.

Therapy.—Vanilla is used in flavoring troches and in making articles of food for the sick. It is added to chocolate during the preparation of this article for the market. It is an aromatic, and probably exerts some stimulating effects upon the human organism, which would make it serviceable in nervous affections. Some persons are more influenced by it than others. Vanilla is said to have aphrodisiac power, possesses stimulant and tonic properties, and has been recommended as appropriate to the treatment of dyspepsia.

Workmen exposed to the dust of vanilla are frequently attacked by papular eruptions upon exposed parts of the body, accompanied by itching and swelling, and followed by desquamation. Coryza and conjunctivitis are also produced by the same cause. Other effects which have been observed are anæmia, headache, giddiness, irritability of the bladder, nervousness, and sexual excitement.

VERATRINA (U. S. P., B. P.).—**Veratrine.**

Preparations.

Oleatum Veratrinæ (U. S. P.).—Oleate of Veratrine (2 per cent.).

Unguentum Veratrinæ (U. S. P., B. P.).—Veratrine Ointment (4 per cent.; B. P. is 2 per cent.).

Pharmacology.—Veratrine is a "mixture of alkaloids obtained from the seeds of Asagræa officinalis (Liliaceæ)" (U. S. P.); "from cevadilla, the dried ripe seeds of Schœnocaulon officinale" (B. P.). Veratrine is readily soluble in alcohol, chloroform, and ether; in water it dissolves in the proportion of 1

part to 1500. **Protoveratrine** and **Protoveratridine** have been recently separated from the rhizome by Sulzberger. The first is extremely toxic; the latter appears to be innocuous.

Physiological Action.—This agent is very irritating to mucous membranes; it powerfully depresses the heart's action, reduces the temperature, and causes fatal collapse. It lowers the sensibility of the sensory nerves. The topical application of veratrine may give rise to erythema, pustules, or petechiæ.

Therapy.—Veratrine, applied to the affected spots, in the form of oleate or ointment, quickly relieves neuralgic and myalgic pains. Veratrine ointment mitigates the pain of herpes zoster, and is used in weakened form in infantile paralysis, for the purpose of promoting the nutrition of the affected muscles. This preparation is beneficially applied in cases of chronic swelling and stiffness of joints, and to the affected articulations in the beginning of a paroxysm of gout. Veratrine ointment is useful in pleurodynia or chronic pleurisy, alopecia circumscripta, chloasma, and pediculosis. For ordinary use the U. S. P. official ointment is too strong, and should be reduced one-half or more. Care should be taken not to introduce any of the ointment into the eyes, or violent conjunctivitis may be set up. The effects should be carefully watched, also, when this ointment is applied upon or near an abraded or denuded surface.

Veratrine has been given internally in rheumatism, neuralgia, etc., in doses of 0.0012 to 0.005 Gm. (or gr. $^1/_{50}$-$^1/_{12}$), but is too depressing. Taylor records that alarming symptoms have been produced by 0.004 Gm. (or gr. $^1/_{16}$) of veratrine.

VERATRUM (U. S. P.).—Veratrum.

Preparations.

Fluidextractum Veratri (U. S. P.).—Fluid Extract of Veratrum. Dose, 0.06 to 2.50 c.cm. (or *m*i-xl).

Tinctura Veratri (U. S. P.).—Tincture of Veratrum (10 per cent.). Dose, 0.18 to 1 c.cm. (or *m*iii-xv).

Pharmacology.—"The dried rhizome and roots of Veratrum viride, American hellebore; or of Veratrum album, white hellebore (Liliaceæ)," are official. It is an indigenous plant which grows in damp places and from its place of growth is called swamp-hellebore, also Indian poke, or poke-root; but is an entirely different species from phytolacca, which yields the poke-root of the United States Pharmacopœia. Veratrum contains **Protoveratrine, Jervine, Rubi-jervine, Pseudojervine**; a bitter glucoside, **Veratramarin,** and **Jervic acid.** Cevadine is present in Veratrum viride, but not in V. album, according to Wright and Luff. Veratroidine, which was formerly regarded as one of its constituents, is thought by Brunton to be, in all probability, simply rubi-jervine with resin. Jervine has not been used medicinally; it constitutes about 50 per cent. of the total alkaloids. It is feebly toxic, and, it is said, does not produce vomiting. It forms crystallizable salts with acids.

Physiological Action.—The action of veratrum is due to the alkaloids which it contains. In small doses of the fluid extract, the pulse is lowered in force, without at first affecting its frequency; it afterward becomes slow, soft, and moderately full, and liable, upon the patient's making any exer-

tion, to become rapid, small, and even imperceptible. Nausea and vomiting frequently occur, with much muscular weakness. Large doses bring on a condition of collapse, with retching, cold and clammy skin, imperceptible pulse, intense muscular weakness, giddiness, and gradual loss of consciousness. **Jervine** is said to lessen greatly the functions of the spinal cord and medulla, especially the vasomotor centre, and at the same time to cause convulsions by irritation of motor centres in the brain, the principal effects being shown in muscular weakness, followed by tremors, lowered blood-pressure, and slow pulse. Bartholow attributed death to asphyxia from paralysis of muscles of respiration, and considered the cerebral effects to be due to the accumulation of carbonic acid in the blood. It is possible that the convulsions may really be due, to some extent, to cerebral anæmia, and that death may occur from syncope. An erythematous or pustular eruption will sometimes follow the internal employment of veratrum.

Treatment of Toxic Effects.—Notwithstanding the very formidable symptoms produced by large doses, fatal effects are rare. An ounce of the tincture has been swallowed without producing death, probably because the prompt emesis which was excited caused the rejection of the most of it. Ordinarily the symptoms are rapidly relieved by the suspension of the remedy and the administration of opium and stimulants. The head should be kept low and the application of external heat is of assistance in the treatment.

Therapy.—The form and mode of administration is of some importance. The fluid extract is a saturated tincture, and resembles, in this respect, Norwood's. The tincture was preferred by Bartholow in doses of 0.30 c.cm. (or *m*v), not at a longer interval than two hours. The recumbent posture must be strictly enforced, in order to avoid the emetic effects, which are so depressing that the remedy is never used for this purpose. In various forms of over-action of the heart, hypertrophy, irritable heart, and the abnormal tension of Bright's disease, it is of great service. It should not be used where there are valvular lesions and the cardiac muscle is enfeebled, or where there is dilated or fatty heart. In aneurism, in conjunction with the proper regimen and rest in bed, veratrum viride favors coagulation of the blood and diminishes the pressure, the effects being carefully watched so as to avoid vomiting. In exophthalmic goitre benefit has resulted from the use of 1.20 to 1.55 c.cm. (or *m*xx-xxv) daily of the tincture.[1] In the first stage of pneumonia and acute congestions of the viscera, there is an accumulation of favorable testimony; it directly reduces the tendency to accumulation of blood, and diminishes the danger of exudation. In pneumonia, when taken at the very beginning, and doses of 0.60 to 1 c.cm. (or *m*x-xv) of the tincture given every two hours or less, until there is a reduction in the pulse-rate and temperature, veratrum will produce the best results; it is useless after fibrinous deposit has taken place. Tincture of veratrum has been employed as an antipyretic in acute rheumatism. In active hæmorrhage or acute mania, in the plethoric, this remedy also moderates the force of the circulation, and may at once check the seizure. In typhoid fever it is inadmissible, except in cases of hyperpyrexia with active delirium. In puerperal convulsions it has been given in doses of 2 c.cm. (or f3ss) of the fluid extract every fifteen minutes until vomiting is produced, or the convulsions cease. It

[1] "Annual of the Universal Medical Sciences," 1890, vol. v, p. A-137.

should not be given if the circulation is weak. Dr. Hutchens, of Bonville, S. C., advises giving a full dose of morphine hypodermically, followed by 1.12 c.cm. (or *m*xviij) of tincture of veratrum in the opposite arm (preferably in the deltoid region), and then the administration of chloroform, and venesection in a plethoric patient.[1] Veratrum, in small doses, often rapidly relieves or cures tonsillitis, especially when combined with morphine, although the latter is otherwise physiologically antagonistic to veratrum.

℞ Tinct. veratri	1|	to	2|	c.cm. or *m*xvi vel xxxij.
Morphinæ sulphatis			065	Gm. or gr. j.
Aquæ menth. pip.	60			c.cm. or f℥ij.

M. Sig.: A teaspoonful every hour or two, until relieved.

Phillips reports that this remedy seemed to relieve a case of persistent priapism after antimony, belladonna, and bromides had failed. It is thought that veratrum has been of value in preventing or diminishing the severity of inflammation after abdominal injuries.

Veratrone is an aseptic, non-alcoholic, permanent solution of veratrum, assayed to the strength of one-fourth of that of the fluid extract (U. S. P.). It is convenient for hypodermic use without dilution. It is prepared by Parke, Davis & Co., of Detroit.

VERBASCUM. — The verbascum thapsus (natural order, Scrophulariaceæ), or mullein-plant, grows by the roadside and in neglected fields. Its leaves are large and woolly, and it bears yellow flowers in dense spikes. The leaves contain a large proportion of mucilage, and a small quantity of volatile oil exists in the flowers.

Physiological Action and Therapy.—Mullein is demulcent, expectorant, and contributes to nutrition. It has long enjoyed a popular repute in Ireland as a remedy in pulmonary affections. Quinlan esteems it of considerable value in phthisis and other wasting diseases. He states that this plant relieves cough, diminishes expectoration, and increases the bodily weight. It is given in the form of an infusion made with milk, 124 Gm. (or ℥iv) of the fresh, or a corresponding quantity of the dry, leaves being boiled for ten minutes in 473 c.cm. (or f℥xvj) of fresh milk. This quantity is to be drunk thrice daily, while still warm. Though the milk doubtless adds to the effect, Quinlan saw benefit result from administration of the juice alone. The taste is unpalatable and is disguised by the milk. It may also be of service in bronchitis and asthma. Mullein has likewise been used in diarrhœa.

VERONAL is diethylmalonylurea, or diethylbarbituric acid. It occurs in small, colorless, odorless, faintly bitter crystals, which are soluble in 145 parts of water. It is hypnotic and sedative. Doses, 0.50 to 1 Gm. (or gr. viiss-xv), given in hot tea or milk at bed-hour. One-half ounce caused death in an elderly woman.[2]

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[1] *Gaillard's Medical Journal*, April, 1900.
[2] *Lancet*, Dec. 30, 1905.

VIBURNUM OPULUS (U. S. P.).—**Viburnum Opulus, Cramp-bark.**
VIBURNUM PRUNIFOLIUM (U. S. P.).—**Black Haw.**

Preparations.

Fluidextractum Viburni Opuli (U. S.P.).—Fluid Extract of Viburnum Opulus. Dose, 1 to 4 c.cm. (or *m*xv-f3j).

Fluidextractum Viburni Prunifolii (U. S. P.).—Fluid Extract of Viburnum Prunifolium. Dose, 1 to 4 c.cm. (or *m*xv-f3j).

Pharmacology.—"The dried bark of Viburnum Opulus" and also "the dried bark of the root of Viburnum prunifolium" (Caprifoliaceæ), are both official. The latter is a tree common in the United States east of the Mississippi. Its height varies from ten to thirty feet. It is generally found upon rocky hill-sides, in rich soil. Its trunk rarely exceeds six inches in diameter. The wood is heavy, hard, and brittle, reddish-brown in color. The bark of the root is the portion employed. The chemical constituents of the bark are **Viburnic acid,** identical with valerianic acid; **Viburnin,** a bitter, resinous body, and also sugar and tannic, oxalic, citric, and malic acids. The bark of Viburnum rufotomentosum is sometimes substituted for the prunifolium bark. Its properties are believed to be similar.

Physiological Action.—It sometimes causes nausea and vomiting, but when retained it is a tonic, astringent, antispasmodic, and nerve-sedative. According to the experiments of Dr. R. L. Payne (Jr.), of Lexington, N. C., upon cold- and warm- blooded animals black haw seems to be without influence on sensibility or consciousness, but has a decided effect upon the centres of motion, producing paresis, followed by paralysis and, finally, loss of all reflex power. Viburnum depresses the heart's action and full doses cause diminution of blood-pressure, partly on account of cardiac weakness and in part from a distinct action on the vasomotor system. Fatal doses occasion paralysis of the heart prior to the cessation of respiration, the heart being arrested in diastole.

Therapy. — The attention of the medical profession was drawn to viburnum by Dr. Phares, of Mississippi, in 1866. This writer described it as "nervine, antispasmodic, tonic, astringent, and diuretic," and of particular value in the prevention of abortion, whether habitual or otherwise, or whether threatened from accidental cause or criminal drugging. An abundance of testimony on both sides of the Atlantic has accumulated to confirm this statement as to its value in threatened abortion. Given before the membranes have been detached, it rarely fails to quiet uterine action, provided the fœtus be living. A number of cases, having the tendency to habitual abortion, have been treated with viburnum by Jenks, Chenes Revill, and others with the most satisfactory results. Black haw affords relief to the after-pains and the so-called "false pains." It has been found of value in the treatment of dysmenorrhœa, especially when associated with profuse flow, and in the absence of serious mechanical obstruction. Even in the latter case, however, it is often able to diminish the pain. In spasmodic dysmenorrhœa it is thought to be more efficient when combined with Jamaica dogwood. Dr. Allan S. Payne obtained very good results from viburnum in severe cases of membranous dysmenorrhœa. In amenorrhœa dependent upon anæmia it is likewise of service. In menorrhagia and metrorrhagia due to systemic causes, as malaria, anæmia, disease of heart or liver, this remedy has proved particularly valuable. The uterine hæmorrhages which attend the menopause, as

well as the various vasomotor and nervous disorders so frequent at that period, are materially relieved by viburnum. Dr. R. D. Style, of Richmond, Va., in charge of the small-pox hospital of that city, remarks that the occurrence of the catamenial epoch during an attack of small-pox is frequently a serious and troublesome complication, but that the use of viburnum in such cases obviates the necessity of a resort to mechanical methods of checking hæmorrhage. The vomiting of pregnancy has occasionally been relieved by this remedy, and its use has sometimes been attended with success in sterility of the female. For its astringent effects viburnum has been given in diarrhœa and dysentery. Dr. R. L. Payne (Jr.), has seen marked reduction of the tremor of paralysis agitans caused by the administration of viburnum. He suggests that its antispasmodic virtues should render it useful in the convulsions of hysteria and hystero-epilepsy, and in *petit mal.* Locally, the diluted fluid extract has been used as a gargle in aphthous sore mouth and as a lotion to indolent ulcers.

Viburnin, which appears to be the active principle of black haw, has been given in doses varying from 0.048 to 0.16 Gm. (or gr. $^{3}/_{4}$-iiss).

The **Viburnum opulus,** or cramp-bark, belongs to the same natural order as the preceding. It is used only in the form of fluid extract, and is given to prevent or relax cramps of all kinds resulting from hysteria, dysmenorrhœa, or pregnancy.

VIOLA TRICOLOR.—Viola tricolor (Violaceæ), heart's ease, or pansy, is a native of Continental Europe and cultivated in the United States. Its medicinal virtue resides in the leaves of the wild plant. Mandelin has discovered that the plant contains salicylic acid. It likewise possesses a small quantity of an emetico-cathartic alkaloid, **Violine**; also existing in Viola odora, or sweet violet. The syrup of viola, made from violets, is a somewhat laxative vehicle for medicines, attractive to children and æsthetic patients.

Physiological Action and Therapy.—The little that has been recorded concerning the physiological action of viola reveals a certain resemblance to the effects of salicylic acid. Viola is said to produce a sense of confusion and dullness in the head, with headache; some dimness of vision; salivation; vesical tenesmus, with frequent and profuse micturition; turbid urine, with offensive odor; a sense of heat over the whole body; sweats, itching, and nettle-rash. The first publication upon the action of this drug seems to have been by Schrack, in 1779, who recommended it as a specific remedy in crusta lactea, or infantile eczema of the head and face. In Germany it gradually fell into disuse, but is still employed in France, and the advocacy of Professor Hardy induced Dr. H. G. Piffard, of New York, to make use of viola in eczema. It is used as an internal medicine. An infusion in milk of the fresh herb, deprived of root and flowers, was long employed. Hardy advised a combination with senna. Piffard now makes use of the fluid extract, and speaks favorably of its results. It is most successful in the second stage, with serous or sero-purulent exudation and crusting. Full doses, given in acute eczema, cause aggravation and extension of the eruption, with increased local heat and itching. These effects continue several days. In order to avoid them, Piffard advises that but from 0.06 to 0.30 c.cm. (or *m*i-v) should, in beginning, be given to a young child, once or twice a day. If no improvement occur, the dose may be increased; if aggravation result, the drug should be discontinued for a few days, and then resumed in smaller

quantity. A larger commencing dose (from 0.60 to 1 c.cm., or *m*x-xv) is required in subacute or chronic eczema. In adults, 2 to 7.5 c.cm. (or f3ss-ij) may be given as the beginning dose in subacute cases. It should be taken in a small quantity of water, on an empty stomach, and, if possible, about half an hour before meals.

VISCUM.—The mistletoe was formerly known botanically as Viscum, but is now called Phoradendron (natural order, Loranthaceæ); the European variety is P. album, the American P. flavescens. They are parasitic plants, the latter growing on oaks, elms, etc. The plant contains mucilage, fixed oil, resin, starch, etc., and **Viscin** ("bird-lime" or "bird-glue"), a viscous, glutinous substance; also found in other plants.

Physiological Action.—Mistletoe is a valuable oxytocic and nerve-sedative. It is a cardiac tonic resembling digitalis in its action upon the cardiac muscle. The berries are succulent and are eaten by birds; but are reported to cause emesis and catharsis, with prostration, bloody stools, and convulsions in children.

Therapy.—In epilepsy, chorea, asthma, and many other nervous affections mistletoe deserves further trial. In weak heart, with insufficient contractile force, it has some value; in uterine hæmorrhage it has been found useful. Viscum has likewise been employed in dropsy and amenorrhœa. It is of service in menorrhagia, and has been used during labor to excite uterine contractions. The use of mistletoe during labor has been earnestly advocated by Dr. W. H. Long, of the United States Marine-Hospital Service, upon the ground of its rapidity of action and its ability to excite intermittent uterine contractions. The dose is 0.65 to 4 Gm. (or gr. x-3j) in decoction, fluid extract, or tincture.

VITELLUS.—Yelk of Egg.

Preparation.

Glyceritum Vitelli.—Glycerite of Egg-yelk (fresh egg-yelk, 45; glycerin, 55 parts). External use.

Pharmacology.—Vitellus is the yelk of the egg of the domestic fowl: Gallus Bankiva (var., domestica; class, Aves; order, Gallinæ). It contains **Vitellin,** resembling casein, **Lecithin,** a phosphorized fat, with albumin, a yellow and fixed oil, cholesterin, salts, sugar, etc.

Physiological Action.—Egg-yelk is a bland, oily substance, very useful in making emulsions. It is highly nourishing, and, as it contains phosphorus, it is especially restorative to the nervous system. The glycerite is a good vehicle for codliver-oil, for children.

Therapy.—Vitellus is beneficial in consumption and wasting diseases, as a special food for the nervous structures, and it can be given in conjunction with codliver-oil, or as a substitute for it. The glycerite is a good application to sore nipples, chapped lips, and hands. It is also used as a protective in erysipelas and other acute skin affections.

WACHICHILI, or **HUARCHICHILE,** is a fever remedy known to the Mexican natives as "huarchichile" (pronounced wa-chi-chile), and catalogued in Dato's Materia Medica as "La Espinosilla." Dr. R. J. Smith states that Cervantes named it Mexican phlox, and it is botanically **Losselia coccinæ.**

The Huarchichile is a low shrub, growing preferably in moist localities in mountainous altitudes, where the sun shines a portion of the day at least. The plant is bright-green, with rich green leaves, and the flower is small and pink, and appears in July and August. The whole above-ground portion of the plant is used, and when chewed it is intensely bitter. For use, the plant is bruised and steeped in cold water. This cold infusion is freely administered, and the uncertain claim is made that eight ounces of the plant will cure a bad case of malarial fever. The properties ascribed to it are anti-periodic and stimulant to the excretory organs. Long-continued cases of malarial affections are said to have yielded to it in two days. The Mexicans use this remedy to break up a cold quickly, in influenza, in chills and fever, to remove the effects of a spree. The women also use it to prevent falling of the hair, rubbing it into the scalp thoroughly. In simple fevers of children it is given with success in the form of recent infusion.[1]

WINTERA.—Winter's bark, the dried bark of Drimys Winteri (Magnoliaceæ), of South America, contains **Winterene** ($C_{15}H_{24}$) as a constituent of its volatile oil; it also has several uncrystallizable resins. The bark has aromatic properties resembling cascarilla. It is used as a tonic to the digestive organs (1.30 to 2 Gm., or gr. xx-xxx) in powder or infusion. It is also highly esteemed as an anti-scorbutic.

XANTHIUM.—Clot-bur. The whole plant of Xanthium strumarium (Compositæ), growing widely in Europe and America, possesses medicinal virtue. A fluid extract is given in the dose of 4 to 7.5 c.cm. (or f3i-ij). It contains a glucoside, **Xanthostrumarin,** according to A. Zander.

Therapy.—Xanthium is alterative, hæmostatic, and is useful in hæmorrhage. In metrorrhagia, post-partum bleeding, and hæmorrhages occurring during the climacteric period this remedy is of value. Clot-bur is serviceable, likewise, in bleeding piles and in dysentery. In strumous enlargement of lymphatic glands and in skin diseases of a scaly form it is reported to be beneficial.

XANTHOXYLUM (U. S. P.).—**Prickly Ash, Tooth-ache Tree.**
Dose, 0.65 to 2 Gm. (or gr. x-xxx).

Preparation.

Fluidextractum Xanthoxyli (U. S. P.).—Fluid Extract of Xanthoxylum. Dose, 2 to 4 c.cm. (or f3ss-j).

Pharmacology.—The dried bark of Xanthoxylum americanum, Northern Prickly Ash; or of Fagara Clava-Herculis, Southern Prickly Ash (Rutaceæ). Their constituents are nearly identical. In the northern bark (X. Americanum), a tasteless, inert, crystalline body, **Xanthoxylin,** is found, and also, in both barks, an alkaloid, probably identical with **berberine.** The bark also contains a volatile oil, resin, gum, a fixed oil, etc.

Physiological Action.—Prickly-ash bark is an aromatic bitter; it is also diaphoretic, diuretic, and sialagogue. It causes augmented secretions along the intestinal tract, including the liver, and has emmenagogue properties. It is also considered alterative. Xanthoxylin slightly increases the action of the heart and raises arterial tension.

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[1] *Chicago Medical Times.*

Therapy.—Xanthoxylum is used in a variety of disorders, from toothache to jaundice. It is an ingredient in the compound syrup of clover, which is used in the treatment of syphilis and scrofula; it is also used in chronic and muscular rheumatism and skin disorders. Prickly ash is a very effective tonic to the mucous membrane of the gastro-intestinal canal. It assists glandular action and can be employed for the treatment of many diseases in which the glands of the skin or mucous membranes are affected.

In functional dysmenorrhœa, or suppression of the menses, prickly ash is successful, in doses of 2 c.cm. (or *m*xxx) of the fluid extract, which is a strong tincture.

In pharyngitis and post-nasal catarrh a decoction may be used as a wash or gargle, and the fluid extract administered internally.

In liver disorders, combined with cascara and other drugs, it is often very decided in its effects.

Xanthoxyli fructus, or prickly-ash berries, contain volatile oil and a resin, and are antiseptic. They are used in fluid extract or decoction, in affections of mucous membranes, especially diarrhœa, cholera morbus, flatulence, colic, etc. The fluid extract is alcoholic, and doubtless the menstruum aids in the effect.

Prickly ash is useful in constipation due to deficiency of the intestinal secretions.

XEROFORM.—Tribromphenol-bismuth. A yellowish-green, tasteless powder, insoluble in ordinary solvents. It consists of equal parts of tribromphenol and bismuth oxide. It is used as a desiccating powder for wounds, being practically odorless, non-irritating, powerfully antiseptic, and capable of being sterilized by heat. It has also been used internally by Fasano, of Naples, as an intestinal antiseptic in daily doses of from 4 to 8 Gm. (or ʒi-ij) for the first three to six days, after which it was gradually reduced. The agent was given in mucilage emulsion or in wafers or capsules, 0.50 Gm. (or gr. viiss) every two hours. There was complete tolerance by the stomach. He also found it valuable in sporadic cholera. In diabetes, the acetonæmic cornea disappeared in a short time, and in uræmia the symptoms were also promptly relieved. Intestinal tuberculosis treated by xeroform showed progressive amelioration, the remedy being given both by the mouth and by the rectum. In laryngeal tubercular ulcers insufflation of this agent relieved the symptoms and, in the course of several months' persistent treatment, cicatrization followed. Hueppe, of Hamburg, used it in the treatment of cases of cholera during the epidemic in daily doses of 6 to 7 Gm. (or ʒiss-i $^{3}/_{4}$). In typhoid fever the stools become deodorized while this remedy is being used.

XYLENE, or XYLOL.—A coal-tar product, dimethylbenzene (C_8H_{10}), resembling benzol and related to toluol, used internally (dose, 0.30 to 1 c.cm., or gtt. v-xv), and diluted as an external application in small-pox; also relieves irritation of the throat when used as a spray.

ZEA (U. S. P.).—**Zea (Corn-silk).**

Dose, 2 Gm. (or gr. xxx), in fluid extract, or infusion (1 to 8).

"The fresh styles and stigmas of Zea mays (Gramineæ)" contain

Maizenic acid, resin, fixed oil, etc. Zea exerts a sedative action upon the bladder. The seed, commonly known in this country as corn, contains a considerable quantity of a bland, yellow, fixed oil,—oleum zea maydis,—which might be utilized in pharmacy in making ointments.[1]

ZINCUM (U. S. P.).—Metallic Zinc.

Salts and Preparations.

Oleatum Zinci.—Oleate of Zinc (a yellowish-white mass of the consistency of ointment).

Unguentum Zinci Oxidi (U. S. P.).—Ointment of Zinc Oxide (20 per cent.).

Zinci Bromidum (U. S. P.).—Zinc Bromide. Dose, 0.065 to 0.13 Gm. (or gr. i-ij).

Zinci Carbonas Præcipitatus (U. S. P.).—Precipitated Zinc Carbonate. Dose, 0.13 to 0.20 Gm. (or gr. ii-iij).

Zinci Iodidum (U. S. P.).—Zinc Iodide. Dose, 0.03 to 0.13 Gm. (or gr. ss-ij).

Zinci Phosphidum.—Zinc Phosphide. Dose, 0.003 to 0.015 Gm. (or gr. $^1/_{20}$-$^1/_4$).

Zinci Acetas (U. S. P., B. P.).—Zinc Acetate. Dose, 0.03 to 0.13 Gm. (or gr. ss-ij), or, as an emetic, gr. 0.65 to 2 Gm. (or gr. x-xxx).

Zinci Chloridum (U. S. P., B. P.).—Chloride of Zinc.

Zinci Oxidum (U. S. P., B. P.).—Zinc Oxide. Dose, 0.20 to 0.65 Gm. (or gr. iii-x).

Zinci Stearas (U. S. P.).—Stearate of Zinc.

Unguentum Zinci Stearatis (U. S. P.).—Ointment of Stearate of Zinc.

Zinci Sulphas (U. S. P., B. P.).—Zinc Sulphate. Dose, 0.065 to 0.20 Gm. (or gr. i-iij) as a tonic; as an emetic, 0.65 to 2 Gm. (or gr. x-xxx).

Zinci Valeras (U. S. P.), Valerianas (B. P.).—Zinc Valerate or Valerianate. Dose, 0.065 to 0.20 Gm. (or gr. i-iij).

Liquor Zinci Chloridi (U. S. P., B. P.).—Solution of Zinc Chloride (50 per cent. by weight).

Zinci Carbonas (B. P.).—Zinci Carbonate. Dose, 0.13 to 0.50 Gm. (or gr. ii-viij).

Zinci Phenol Sulphonas (U. S. P.), Sulphocarbolas (B. P.).—Zinc Phenolsulphonate. Dose, 0.06 to 0.20 Gm. (or gr. i-iij).

Unguentum Zinci (B. P.).—Zinc Ointment (15 per cent.).

Unguentum Zinci Oleatis (B. P.).—Zinc-Oleate Ointment.

Zinci Lactas.—Zinc Lactate. Dose, 0.03 to 0.065 Gm. (or gr. ss-j).

Zinci Cyanidum.—Zinc Cyanide. Dose, 0.015 to 0.10 Gm. (or gr. $^1/_4$-iss).

Zinci Permanganas.—Permanganate of Zinc. Used as an antiseptic and astringent application.

Pharmacology.—Zincum is metallic zinc, in the form of sheets or of irregular, granulated pieces. It is a silvery metal when polished, but soon tarnishes, and, when exposed to the air, forms oxide or carbonate. The zinc salts are white, and are usually soluble in water, but the oxide, carbonate, phosphide, and cyanide are insoluble. The soluble salts are usually poisonous, and zinc cannot be used for cooking utensils on this account.

Physiological Action.—Most of the salts of zinc are astringents, but some are corrosive poisons; among the latter are the chloride, acetate, sulphate, iodide, and cyanide. They produce pain, nausea, vomiting with great retching, and sometimes catharsis and muscular depression. Toxic doses of zinc oxide, experimentally administered to animals by d'Amore and Falgone, gave rise to vomiting, hæmoglobinuria, albuminuria, and glycosuria.

Continued use of zinc salts causes symptoms of disorder of the nerve-centres resembling those of lead poisoning, showing less tendency to accumulate in the system than some other metals; but, elimination, as in other cases, takes place through the action of the liver and intestinal glands. In cases

[1] An interesting article on "Oil of Indian Corn," by Dr. Charles O. Curtman, appeared in the *Drugman*, July 25, 1886.

of poisoning, the object of treatment would be to favor evacuation and to relieve symptoms. It is best to give flour and water, or milk, or soapy water; the alkaline bicarbonates, especially soda, are the chemical antidotes. The hypodermic injection of morphine may be required to relieve vomiting. Subsequently, the use of potassium iodide, warm baths, and laxatives will remove the metal compounds from the tissues.

Therapy.—In weak solutions, the zinc salts may be employed as astringents. The acetate (0.03 to 0.065 Gm., or gr. ss-j) in rose-water (30 c.cm., or f℥j) is useful as a collyrium in conjunctivitis; it is beneficial, also, as an injection in gonorrhœa and gleet:—

℞ Zinci sulph.	2	Gm. or gr. v.
Bismuth. subnit.	6	Gm. or ʒiss.
Glycerini	15	c.cm. or f℥ss.
Aquæ cinnamomi q. s. ad	150	c.cm. or f℥v.

M. For injection in gonorrhœa after the acute stage has passed.

℞ Zinci sulph.	8	Gm. or gr. vj.
Tinct. opii deod.,		
Tinct. catechu aa	15	c.cm. or f℥ss.
Aquæ rosæ	60	c.cm. or f℥ij.

M. Sig.: For injection in chronic gonorrhœa or gleet.

Injections of zinc permanganate were highly esteemed, by the late Mr. Berkeley Hill, in acute gonorrhœa. He generally made use of a solution containing 0.065 Gm. (or gr. j) of the salt to 240 c.cm. (or Oss) of distilled water. The salt should always be employed alone and in distilled water.

The sulphate of zinc may be used to destroy small malignant growths of the skin. The water of crystallization is driven off by heat, and the salt powdered finely and mixed with a little simple cerate, or oleate of zinc ointment. The action is limited by applying a piece of adhesive plaster with a hole cut in corresponding to the part to be attacked. Several applications may be needed.[1]

The sulphate is likewise used as a collyrium (0.13 to 0.25 Gm. to 30 c.cm., or gr. ii-iv to f℥j), especially when conjunctivitis tends to become chronic, and is beneficial in inflammations of the skin. In acne Dr. Fred. J. Leviseur[2] uses in conjunction with hot-water applications:—

℞ Zinci sulphatis,		
Potassii sulphitis aa	4	Gm. or ʒj.
Aquæ rosæ	120	c.cm. or f℥iv.

Dissolve each ingredient separately in 60 c.cm. (or f℥ij) of the rose-water, mix, and add:—

Resorcini	4	Gm. or ʒj.

Sig.: Lotion; shake well. This is to be used hot at night and cold in the morning.

The ointment of zinc oxide is largely used as a protective and slightly astringent application to acute skin affections, and to an ounce or more can be added carbolic acid, 2 Gm. (or ʒss); oil of cade, 4 c.cm. (or f℥j); tar, 2 to 4 c.cm. (or f℥ss-j), and other agents, according to the case, for treatment of eczema, herpes, erysipelas, and burns. The zinc-glue recommended by Unna as forming a stiff surgical dressing consists of 10 parts of zinc oxide, 30 parts

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[1] D. H. Patton, Woodward, Oklahoma (*Medical World*, Aug., 1903).
[2] *Medical Record*, Sept. 13, 1890.

each of gelatin, glycerin, and water. The preparation is rubbed into the gauze or muslin of the bandage. The chloride is a powerful caustic and antiseptic. In dilute solution (0.065 to 0.13 Gm. to 240 c.cm., or gr. i-ii to f℥viij) it is useful as an injection in gonorrhœa or leucorrhœa. It has been suggested that this salt may be rendered more efficient by mixing it with lanolin or some bland oil and allowing it to remain for a few minutes in the urethra. The following formula is proposed:—

℞ Zinci chloridi	38	Gm. or gr. vj.
Adipis lanæ hydrosi	6	Gm. or ʒiss.
Aquæ	90	c.cm. or f℥iij.
Ol. olivæ	q. s. ad 360	c.cm. or f℥xij.—M.

In stronger solutions, or mixed into a paste with flour and water, zinc chloride can be applied to lupus or malignant growths, to be used for creating sloughs.

Zinc chloride, in the form of a paste, made with starch, or 4 parts of zinc chloride; farina, 3 parts; zinc oxide, 1 part, as used by Vohwinkel, is often a very effective application to morbid growths. Haberlin (*Correspondenz-blatt für Schweizer Aerzte*), in inoperable uterine carcinoma, employs a paste of zinc chloride, which he regards as a good palliative treatment. Penrose, of Philadelphia, has likewise applied zinc chloride in the form of a saturated solution by means of a tampon in malignant disease of the uterus with decidedly good effect. This salt may also be employed for the purpose of destroying epitheliomata, nævi, enlarged glands, warts, and condylomata. The liquor is a strong preparation, and, greatly diluted (4 c.cm. to 473 c.cm., or f℥i-Oj), it is a detergent and stimulating application to old ulcers, and has likewise been employed as a disinfectant for wounds. In chronic laryngitis, F. J. Stewart[1] recommends daily applications with the laryngeal brush, of solutions of zinc chloride ($^1/_2$ to 1 per cent.), combined with frequent spraying with menthol in liquid petrolatum.

Zinc iodide is only used in ointment for enlarged glands (4 Gm. to 31 Gm., or ʒi-℥j of simple ointment), or in solution as an application to enlarged tonsils. The oxide, when in a smooth, dry powder, is useful as a dusting-powder, for infants, but the carbonate is better for this purpose. Oleate of zinc has been already considered. W. D. Haslam states that a mixture of equal parts of iodoform and oleate of zinc is of great value in gynæcology, applied by insufflation or on a tampon.

Zinc subgallate has been recently recommended as an efficient antiseptic and desiccant dressing in the treatment of eczema, wounds, otorrhœa, and hæmorrhoids. The preparation is applied pure, or it may be diluted with inert powders or ointments. Suspended in water and mucilage in the proportion of 1 to 16 it constitutes a useful injection in gonorrhœa. Zinc subgallate has been employed in doses of 0.03 to 0.25 Gm. (or gr. ss-iv) with alleged good results in fermentative dyspepsia and night-sweats.

The application of solutions of zinc, especially of the chloride, is not without danger. It has been the practice of some gynæcologists to apply zinc chloride to the inner surface of the uterus in the treatment of metritis. Dr. Pozzi warns against its use in young women and in acute inflammation, on account of the risk of producing atresia and obliteration of the uterine

[1] *Guy's Hospital Gazette*, Jan. 27, 1900.

cavity, or setting up tubal inflammation. Doleris[1] prefers curetting to the application of caustics, which also received the sanction of Goodell. Aseptic curetting is commonly safe, and causes no such ill effects, even in complicated cases.

In a case of recurrent luxation of the shoulder, Dubreuilh overcame the tendency to dislocation by six hypodermic injections, performed every second or third day, of 0.12 c.cm. (or *m*ij) of a 10-per-cent. solution of zinc chloride. The fluid was deposited in various portions of the anterior superior portion of the capsule below the acromion process.

Injections of zinc chloride have also been employed, with reported advantage, in order to promote union of fractured bones. About 1 c.cm. (or *m*xv) of a 1-per-cent. solution are injected into the neighborhood of the fracture. The same procedure has likewise been made use of in pulmonary tuberculosis. Dr. Jules Comby has resorted to this method in a number of cases, and states that the results were favorable and that the treatment merits further trial. The strength of the solutions which he used varied from 1 in 50 to 1 in 20, and 0.18 c.cm. (or *m*iij) were introduced every third or fourth day. All the cases thus managed were in an early stage, and the disease was confined to the apices. The object of the treatment is to favor the formation of fibrous tissue and produce a cure in the same manner as occurs in the natural arrest of the disease. The same plan has been applied in cases of tuberculosis of joints and in lupus.

Zinc sulphate is a decided astringent, and in doses of 0.65 to 1.20 Gm. (or gr. x-xx) is a prompt emetic. It has been used for the latter purpose in narcotic poisoning, croup, and for promptly evacuating the stomach. It is a systemic emetic, and causes vomiting when injected into the blood. As an astringent, it has been administered in combination with opium or Dover's powder, in diarrhœa, and chronic dysentery. In small doses, it has been employed as an antispasmodic in asthma, chorea, epilepsy, angina pectoris, hysteria, etc. The stomach becomes remarkably tolerant of the sulphate, so that as much as 2.60 Gm. (or gr. xl) have been given, thrice daily, without exciting sickness of the stomach. Such massive doses, however, should not be long continued, as they eventually occasion superficial ulceration of the stomach. Zinc sulphate is also occasionally employed internally for the relief of bronchorrhœa.

In the treatment of chorea, zinc sulphate is used, beginning with 0.065 Gm. (or gr. j) doses three times daily and gradually increasing them until the limit of tolerance is reached. A case has been recorded by Dr. J. Sidney Hunt in which traumatic tetanus was successfully treated by a combination of opium and zinc sulphate. Zinc phenolsulphonate is an antiseptic and astringent. Dr. W. F. Waugh has used this salt for several years in cholera infantum and typhoid fever, and all cases in which the occurrence of fetid stools, with tympanites, etc., indicates the need of intestinal antisepsis. In typhoid fever he claims to have treated upward of seventy cases, with no death in any case where this salt was employed from the beginning. The dose is 0.03 to 0.065 Gm. (or gr. ss-j) for children, 0.16 to 0.32 Gm. (or gr. iiss-v) for adults, to be given every two hours until the stools are odorless, and thereafter in doses sufficient to keep the stools in this condition. The effects are a reduction of the fever, tympanites, diarrhœa, and delirium; the attack

[1] *Provincial Medical Journal*, Dec. 1, 1890.

is shortened and rendered less dangerous. When the symptoms of cholera infantum assume the dysenteric form, the zinc is given in enemas, 0.65 Gm. in 60 c.cm. (or gr. x-f℥ij) of warm water. Zinc cyanide is used in Germany as a substitute for hydrocyanic acid; the dose is 0.015 Gm. (or gr. $^1/_4$) gradually increased to 0.10 Gm. (or gr. iss) given in a mixture. It has also been employed in epilepsy, chorea, and in neuralgia, in painful affections of the stomach, and dysmenorrhœa. Professor Lashkevich recommends the cyanide in the treatment of palpitation, want of rhythm, and pain in the region of the heart.

In many nervous affections, the zinc valerate has special advantages over other salts in neuralgia, nervous headache, nervous cough, ovaralgia, chorea, epilepsy, etc.; if given in small doses, repeated at short intervals, it is beneficial. The night-sweating of phthisis is sometimes checked by zinc oxide, given in pill form (0.20 Gm., or gr. iij, at night); the oxide may also be given in the summer diarrhœa of infants or adults. In chorea the same salt is of much value alone, or combined as follows: —

℞ Zinci oxidi ..... 32 Gm. or gr. v.
Ferri pyrophos. ..... 2 60 Gm or gr. xl.
M. et ft. pil. no. xx.
Sig.: Two or three pills a day.

Zinc oxide is serviceable in gastralgia, and has sometimes proved useful in epilepsy. Bartholow believed that it is most successful when epilepsy is the result of peripheral irritation, having its origin in the stomach. The same writer esteemed the oxide as of prophylactic value in spasmodic asthma. Whooping-cough and chronic alcoholism have their symptoms relieved by the oxide, which has also been advantageously employed in chorea. The tremors and unsteadiness due to chronic alcoholism will sometimes yield to the influence of zinc oxide, and Guéneau de Mussy reported it as of value in subduing the tremor caused by mercurial and arsenical poisoning. Zinc lactate has been serviceably administered by von Graefe and others in rapidly developing cases of amblyopia, especially when of hysterical origin. Zinc cyanide has sometimes relieved the pains of articular rheumatism, but its use is apt to be followed by headache and it has been effectually superseded by more modern remedies.

ZINGIBER (U. S. P., B. P.).—**Ginger.**
Dose, 0.65 to 1 Gm. (or gr. x-xv).

Preparations.

Fluidextractum Zingiberis (U. S. P.).—Fluid Extract of Ginger. Dose, 0.06 to 1.20 c.cm. (or *m*i-xx).

Oleoresinæ Zingiberis (U. S. P.).—Oleoresin of Ginger. Dose, 0.03 to 0.12 c.cm. (or *m*ss-ij).

Syrupus Zingiberis (U. S. P., B. P.).—Syrup of Ginger. Dose, 4 to 15 c.cm. (or f3i-iv). B. P., 2 to 4 c.cm. (or f3ss-j).

Tinctura Zingiberis (U. S. P., B. P.).—Tincture of Ginger (20 per cent.). Dose, 2 to 8 c.cm. (or *m*xxx-f3ij).

It also enters into aromatic powder and compound rhubarb powder (U. S. P., B. P.).

Pharmacology.—Ginger is the dried rhizome of Zingiber officinale (Zingiberaceæ), cultivated in tropical countries as a spice. Ginger from which the cortex has been scraped is also known as "white" or "peeled" ginger. It is less active than the whole ginger. Green ginger is put up in syrup or

candied, and used as a digestive condiment at the dinner-table as a corrective of flatulence. It comes from different sources, but the Jamaica ginger is preferred for culinary purposes, having the best flavor. An excellent ginger comes from Shimonoseki, Japan. Ginger contains traces of an alkaloid, but its activity depends principally on a volatile oil, consisting principally of **Gingerol,** and also a pungent resin. The tincture, spirits, or essence of ginger is a very popular remedy. Unfortunately, it is very frequently made with wood alcohol, which makes a cheaper article, but persons taking it too freely are likely to suffer with symptoms of amylic alcohol poisoning. A characteristic symptom is atrophy of the optic nerve and blindness. Death has been caused by the use of this adulterated product.

Physiological Action.—It is an agreeable carminative and stimulant, increasing the secretions and promoting peristalsis. It increases slightly the amount of urine, and acts as an irritant to the bladder and urethra. Externally it is rubefacient.

Therapy.—Ginger is added to purgative pills to prevent griping, and to salines in order to disguise their taste. It is useful in atonic dyspepsia, especially in elderly persons, and is of service in flatulence and diarrhœa. The syrup is commonly used as a vehicle for stomachic preparations and tonics. The addition of 4 to 7.5 c.cm. (or f℥i-ij) of the tincture to a glassful of hot water (180 c.cm., or f℥vj) makes "ginger-tea," which is useful in flatulent colic, in diarrhœa of relaxation, and in dysmenorrhœa due to cold. By the use of a hot foot-bath with free use of ginger-tea, diaphoresis may be excited and further progress of colds checked.

PART III.

NON-PHARMACAL REMEDIES AND EXPEDIENTS EMPLOYED IN MEDICINE NOT CLASSED WITH DRUGS.

THIS portion of the work will be devoted to the discussion of certain agents and expedients employed in clinical therapeutics which cannot be properly classed with drugs. Each will be considered under its own heading, with the following titles: "Electro-therapeutics"; "Kinesitherapy, Massage, and Rest-Cure"; "Pneumotherapy"; "Hydrotherapy and Balneology"; "Mineral Springs"; "Climatotherapy"; "Diet in Disease"; "Psychotherapy, Metallotherapy, and Suggestion or Hypnotism"; "Heat and Cold," "Light and Darkness," "Music," etc., concluding with a brief review of various methods and expedients, chiefly mechanical and local in their effects. Although the latter find a limited place in practical medicine, they are, as a rule, surgical expedients, and are, therefore, in this place, less fully considered than they would be in a treatise specially devoted to that department.

ELECTRICITY IN MEDICINE—ELECTRO-THERAPEUTICS.

Present Standing and Importance of Electro-therapeutics.—The scientific application of electricity to the human body for the treatment of disease has recently been greatly stimulated by its remarkable commercial development. Electrical science being essentially of modern origin, new principles and new economical applications being announced almost daily, it becomes absolutely necessary for a discussion of the employment of electricity in medicine to be introduced by a few words upon the present state of our knowledge of this department of physical science. A very brief consideration of the laws of electricity, with explanation of its terms and its technique, therefore, will precede a review of its therapeutic applications. It is unfortunate and embarrassing, to the medical student particularly, to find confronting him, at the very threshold of this subject, a mass of literature which has come down from a period when purely empirical methods prevailed and the nature of this force and its effects, both physiological and therapeutical, were very imperfectly understood. Not infrequently, even at the present day, medical writers betray a want of knowledge of its fundamental principles. There is less excuse for this now than ever before, because the ingenuity of electricians and expert instrument-manufacturers has been attracted in this direction and has brought to our aid apparatus of precision, both for therapeutics and for diagnosis, with which it is the duty of every physician to acquaint himself. Even if he does not purpose to apply it to a great extent in his practice, he should do this much, at least, for his own protection, since he must at times rely upon some form of apparatus; and some of the elec-

trical instruments which are offered for sale are of poor construction, entirely unfit for medical use. Moreover, many persons bring discredit upon medical electricity by claiming to be specialists who are mere tyros, if not open charlatans, ignorant of the first principles of medical or of physical science. It is a comparatively easy matter for the well-trained physician to recognize and expose such pretenders, especially should they venture to boast of their results in public or before medical societies.

The Foundation of Success in Electro-therapeutics.—The study of electro-therapeutics requires not only that we shall be versed in the laws and terms of electrical science, but also that we shall have good anatomical and physiological knowledge. It is, moreover, very evident that we must be familiar with pathology in its most comprehensive sense, in order to form a correct judgment, or prognosis, as regards the probable utility of electrical or any other treatment in a given condition, so that this valuable agent may not be brought into disrepute by being used in unsuitable cases. As it is necessary that such knowledge shall be acquired systematically, all reputable medical schools now strive to teach thoroughly the principles of electricity and the construction of medical electrical apparatus and batteries, this course of study being made practical and attractive by abundant didactic and clinical instruction in this important branch of therapeutics. Since the best results can be obtained in this direction only by a due recognition of the dignity of this branch in the curriculum, it is hoped that there soon will be established a chair of electro-therapeutics in every university and medical college in the country.

Definition of Electricity.—The phenomena of electrification are due to a **condition of matter when it is acted upon by a peculiar force known as electromotive force.** This "electromotive force" is a form of energy which is convertible into and is, therefore, said to be correlated with the other physical forces, in accordance with the well-known law of conservation of force demonstrated by Helmholtz. That is to say that, whereas light, heat, motion, chemical action (electrolysis), and magnetism may be obtained from electricity, so, by the law of the correlation of forces, light, heat, motion, chemical action, and magnetism may be transformed back again and be manifested as electricity. These forces are all manifestations of molecular motion due to radiant energy, acting under different conditions.

Principle Underlying Electrical Manifestations.—It is upon this principle that all forms of apparatus for economical and medical applications of electricity are constructed. Atmospheric electricity, which Benjamin Franklin proved to be identical with friction-electricity, certainly exerts an important influence upon health; and instances have been recorded where an electrical shock (lightning-stroke) has been followed by important physiological changes (*i.e.*, relief from paralysis, etc.); but no attempt at systematic therapeutic application has, as yet, been made with electricity from this source directly. The usual sources are chemical action, heat, magnetism, and motion (friction and dynamo).

The Electric Current: its Physical Characters and Properties.—Although electricity is simply a condition of matter, or a "mode of motion,"—a "peculiar vibration or tension of the molecules of a body said to be electrified,"—it is convenient to speak of it as if substantial, and, in fact, as matter in a fluid state. In some respects it appears to be analogous to water when the latter is acted upon by the force of gravity and atmospheric pressure;

and authors have fallen into the habit, for convenience of description, of speaking of it as "the electric fluid," "the electric current"; also of the direction in which the current "flows"; its "pressure"; the "resistance" it encounters from poor "conductors"; the "waste of the current"; a "continuous" or "interrupted" current, and so on, the simile being heightened by comparing the dynamo, or source of the current, with a steam force-pump. It must be constantly kept in mind, however, that this is figurative language, adopted simply for convenience. It should not be inferred, for instance, when the human body is in circuit, that anything material flows through the body; the correct view is that the parts between the poles are more or less affected by a peculiar form of molecular activity which takes place in the tissues, and during this period the parts are in a characteristic condition, which will be referred to later on. This change may be simply physiological, and not inconsistent with restoration to a healthy condition; or it may be pathological, and produce permanent lesions. If the current be sufficiently powerful, decomposition will be produced (electrolysis), or the parts adjacent to the poles may be carbonized or blistered by the development of heat produced by resistance to the current (galvanic cauterization, or electrocausis).

Correlation of Electrical and Other Forms of Force.—Electricity, therefore, cannot be said to have a separate existence of its own, electrification being simply a state or condition of matter depending upon the exercise of a force which produces certain physical, chemical, and physiological effects. The laws governing electrical action have been formulated, so that it may now be applied to medical and other economical purposes with precision and absolute control. Progress in every department of science depends upon the accuracy of measurement, which affords an opportunity for exact comparison and record. Electricity is no exception to this, although, owing to its nature, it presents peculiar difficulties not met with in other departments.

Electrical force is so easily converted into other forms of energy that it almost defies ordinary methods of measuring, such as are used in estimating velocity, weight, or heat. With the best conductors, its passage between distant points exceeds the rapidity of light.

Electrification and Electro-magnetism.—As already stated, electrification comprises the phenomena occurring in a peculiar state which matter may assume under special conditions. Certain bodies, while in this state, exhibit peculiar and characteristic phenomena. For instance, when two dissimilar metals, capable of being electrified, are partly immersed in a liquid capable both of permitting the passage of the current and of acting chemically upon one of them (*i.e.*, an electrolyte), if the free portions (or parts outside the fluid) of the two metals are brought in contact or connected by a metallic conductor, such as a piece of copper wire, certain results may be observed to occur. One metal is slowly acted upon by the fluid; the other is not; but bubbles of hydrogen appear upon its surface. Under such circumstances the external junction of the two metals will be found to possess electrical properties. Usually, for convenience, the metals are united by a conjunctive wire, which must also be capable of becoming electrified and of acting as a conductor (or rheophore). When in this condition, in relation to the two metals just mentioned, the wire will attract iron filings; or, if brought over a compass parallel with the needle, or a bar magnet suspended by its centre, it will cause deflection of the magnetic needle, which, if the current be

strong enough, tends to assume a position at right angles to the wire, deviating more or less from the magnetic pole and the so-called cardinal points of the compass. If a coil of wire be suspended so as to be free to move in all directions, it will, under the influence of an electric current passing through from one end of the wire to the other, assume a north-and-south polar position, in the line of the magnetic meridian of the earth. Such a coil, while electrified, therefore, has assumed the properties of a magnet; it also attracts small pieces of iron, and may be used to convert a mass of steel or hard iron into a permanent magnet. If into the centre of a long coil, or spool, of insulated wire some **soft** iron (which does not become permanently magnetized) be inserted, we have a temporary **electro-magnet** formed, which only exhibits the properties of a magnet when the current is passing in the coil. This principle is of great utility, and appears in the interrupting mechanism of faradic batteries, telegraph-sounders, telephone-receivers, electric-light generators (dynamos), and numerous other forms of apparatus.

Intimate Relationship of Electricity and Magnetism.—There are many points of similarity between electricity and magnetism. The most plausible explanation of the latter is that the magnet is in a permanent molecular state, which corresponds with electric currents surrounding the poles. Similarly, the conjunctive wire, during the pasage of the electric current, is in a condition in which it influences the magnetic condition of other objects near it, just as if it were surrounded by **lines of force** in a series of concentric rings. This may be illustrated, if not demonstrated, by placing some iron filings upon a plate of glass or a card and applying a strong magnet beneath, or by running a wire carrying a current perpendicularly through its centre. The iron filings will, under the influence of electricity, arrange themselves in concentric circles, exhibiting the directions of the lines of force, just as they do around the poles of the magnet.

Lines of Force.—These lines of force, in the case of the magnet, flow in the air from the north to the south pole and back again through the iron, thus making a permanent closed circuit. In the case of the wire, the concentric lines or whirls of force encircle the electrified conjunctive wire; so that, when consecutive loops are arranged in the form of a helix or coil, the lines of force become parallel with the long axis, and the coil now exhibits magnetic properties. The space in which these phenomena are noted is considered the magnetic field, or area of induction. By reversing the experiment and passing a permanent magnet into a coil of wire, a current of electricity is temporarily set up, which is manifested at the extremities of the wire. This is the principle upon which magneto-electric machines are made or electric-light dynamos constructed. Coils or spools containing insulated bundles of soft-iron wire may be placed upon a frame and made to revolve rapidly within the magnetic field around the poles of a large magnet. When this is done electric currents are set up, which are momentary; but, when a high speed is attained, they become practically continuous. By an ingenious arrangement in wrapping the wires, the currents set up on entering the field and upon leaving it, which are in different directions, may be "commutated," or switched, so that they are made to reinforce each other, and thus make a single current of definite direction and practically continuous.

Properties and Effects of the Current.—The effects of electricity are (1) physical and chemical, (2) physiological, (3) therapeutical. The methods of generating electricity are (1) physical [friction-electricity, thermo-electricity,

dynamo-electricity, etc.], (2) chemical [galvanic cell], and (3) physiological [as shown by certain fishes,—torpedo,—and the human body to a less marked degree]. Electricity is the same force under all circumstances; but each form of current possesses certain qualities, which depend upon the method of its generation. The principal qualities of an electric current are constancy, pressure, and volume. Assuming that a current under consideration is constant, or practically so, we have only to keep in mind the two latter,—pressure and volume,—and when these are well understood the difficulties of comprehension of electrical phenomena, about which so much has been written, almost entirely disappear. Returning to the analogy already named, of a pump forcing water through a pipe, we may regard every device for originating a current of electricity as a pump of more or less power. To complete the analogy, the discharge-pipe should be long enough to go around the circuit and terminate in the suction-pipe, so that, the pump being set in motion and the apparatus filled with water, the current of water will be continuous. The force which starts the water is heat converted into motion; that which starts electricity is electromotive force acting under a certain amount of tension or pressure, which will be shown hereafter to be due to difference of potential. If the power is withdrawn, the circulation will cease, because of the obstruction (friction, inertia) which the water has to overcome. In hydraulics, the force required to perform the work, with the resistance, is the subject of calculation, and the size and character of the engine are regulated according to the work to be done. In electricity, the amount of electromotive force or power of the apparatus is measured by **volts** instead of foot-pounds, and the resistance or friction is calculated according to a standard unit of resistance, known as the **ohm.** Just as, in the case of water, with a certain amount of pressure against a given amount of resistance, a definite number of gallons per minute will flow along the conductor, so, in electrical terms, we have a definite volume or strength of current, resulting from a certain amount of voltage against a given number of ohms of resistance. It is easily seen that a powerful pump would be at a great disadvantage in trying to force water through a half-inch pipe, and this difficulty is increased should the pipe be long. In order to get satisfactory results the pipe must be sufficiently large to carry off the water with facility and not offer too much resistance by friction. Therefore large pipes are better conductors than small, and short better than long ones. This is also true in electricity, and the rule is that **the conducting power** (other things being equal) **of a conductor is directly in proportion to the area of the cross-section and inversely to the length.**

Electromotive Force—Difference of Potential.—To return, now, to the first illustration of two dissimilar metals in the electrolyte, we find that the current starts simultaneously with the joining of the metals (either directly or by means of a conjunctive wire), which "closes the circuit" and makes a current possible. The force which starts the current is called the electromotive force; it is always the same for the identical combination of metals, and is independent of the size of the plates. The hypothesis with regard to the origin of the electromotive force is that it is due to a difference of potential of the two plates, the current flowing from the higher potential to the lower, just as water will flow from the higher level to a lower in case two reservoirs are connected. The higher is the positive (or anode), and the lower potential is called the negative (or cathode), and identical metals always

have the same relation to each other when in the same electrolyte, one being known as the generating plate, the other as the collecting plate.

Electrical Measurements: Volts, Ohms, and Ampères. — The unit of measurement of electromotive force, as already stated, is the **volt,** which is a little less than the electromotive force of the zinc and copper combination in the Daniell cell (which is $1\,^{79}/_{1000}$ volts). The unit of measurement of resistance is called an **ohm;** it is represented by the resistance offered by a column of pure mercury, 106 centimetres long and 1 square millimetre in area of cross-section, at a temperature of 32° F. This is called the legal ohm, because it was adopted by the International Electrical Congress, which met in Paris in 1884; it is a little less than the British Association unit, which previously had been the standard,—in the proportion of 1 to 1.0122. The resistance referred to is mainly that encountered by the lines of force in passing through the surrounding media; the tissues composing the human body, for instance, offer considerable resistance to the passage of the current, depending, of course, upon how far the current is required to pass through the tissues, upon the size of the electrodes, and other circumstances.

The volt, or unit of electromotive force, is sufficient to overcome a total resistance equivalent to one ohm and supply a volume of current equal to one ampère. The **ampère,** therefore, is the amount of current produced when one volt of pressure is opposed by one ohm of resistance; it is the unit of measurement of current-strength. It is directly proportional to and may be measured by the amount of chemical decomposition (electrolysis) produced by the current in a unit of time. Thus, the current that will deposit 0.00111815 gramme (or 0.017253 grain) of silver upon a silver plate immersed in a standard solution of silver nitrate in a second of time has the strength of 1 ampère. This amount of electricity being more than is ever required for medical purposes, the unit is divided, for convenience, into thousandths, or **milliampères.** Any number of ampères can be sent through a conductor, provided the generator has sufficient electromotive force and the conductor itself can carry the current; if the resistance be too great the wire will be destroyed by being fused or vaporized. In other words, where the resistance becomes disproportional, the electricity, according to the law of correlation of forces, is liable to become converted into heat and light.

Ohm's Law.—The number of ampères of current flowing through a conjunctive wire within a given time depends upon both the electromotive force, or pressure, and the resistance. This is expressed mathematically as follows:—

$$\text{Intensity of current-strength} = \frac{\text{Pressure, or electromotive force (volts),}}{\text{Resistance, external and internal (ohms),}}$$

or $C\,S = \frac{E}{R}$. In other words, the strength of any current is **directly** as the voltage and **inversely** as the total resistance. The above is known as Ohm's law, which has constant practical applications, as will be demonstrated in the pages that follow.

Passage of the Current—Rheophores, Electrodes, Anode and Cathode Poles.—To confine ourselves for the present to the **galvanic cell,** we observe that the electrical impulse starts from the surface of the plate, which is chemically acted upon (generating, or positive, plate), and is conducted through the electrolyte to the negative, or collecting, plate, from whence it passes along the conjunctive wire in the opposite direction until the place of origin is reached. Should the conjunctive wire be divided in its course,

the end connected with the collecting plate will be the **anode**, or positive; the other extremity is the **cathode**, or negative pole,—these names having reference to the course of the current, which is always from the anode to the cathode, or from the positive to the negative pole. In the closed circuit, therefore, the circuit is completed by the conjunctive wire above and by the intervening column of liquid below. As metals are usually better electrical conductors than liquids, it follows that the current encounters, under ordinary circumstances, the greater resistance inside of the cell (internal resistance), since the resistance offered by the conjunctive wire, which is a metallic connection usually (external resistance), is comparatively small.

Practical Work of a Battery—Electrolysis.—It may be laid down, as a rule, for any given battery that its efficiency will be at the maximum when the electromotive force is sufficient for the work desired to be done and the external and internal resistances are balanced, or equal. The external resistance arises partly from the nature of work to be done and partly from the resistance offered by the conductor, being increased according to its length and diminished according to its thickness. This also applies to the column of fluid between the plates. Therefore we reduce the internal resistance if we bring the plates close together, and also increase their size so as to expose a larger surface in contact with the liquid, which, in effect, increases the thickness (cross-section) of the intervening column. The electromotive force or pressure is increased by multiplying the number of cells until we obtain the required voltage for the work to be performed, or resistance to be overcome. The **work** is a part of the external resistance, and both it and the required current-strength are now matters of mathematical calculation and measurement. Where the work does not require much current-strength, as in heating the cautery, or electrolysis, the external resistance, therefore, not being very great, the battery may be balanced by increasing the size of the plates, using only a comparatively small number of cells. Where, on the contrary, the work requires great current-strength, as where the human tissues are made part of the circuit, the plates should be of convenient, moderate size, but the electromotive force must be increased by additional elements (more voltage); so that for ordinary medical work from 20 to 80 or more cells would be needed. It is evident, therefore, that the battery must be adapted to the work required of it; a galvanocautery battery will not do for general medical purposes, nor can the ordinary small-celled medical battery be economically used for the cautery. The reason for this is obvious from the preceding explanation; any further attempt at a mathematical demonstration would only cause confusion. The larger cells cause more rapid decomposition of an electrolyte (or deposit a greater quantity of silver from the solution in the voltameter in a unit of time), or afford greater ampèrage of current with a good conductor, than where small cells are used, because the larger cells have less internal resistance; and this is found to correspond with the results of experience.

In order to ascertain the number of ampères of current flowing through a circuit, divide the number of volts of electromotive force by the number of ohms of resistance in the entire circuit. Thus, we have by Ohm's law:—

$$C \text{ (current-strength in ampères)} = \frac{E \text{ (electromotive force, in volts)}}{R \text{ (total resistance, in ohms)}}$$

The electromotive force of each cell, when acting and in good order,

is fixed and is invariable for the same combination, without regard to the size of the elements. The entire electromotive force (voltage) is the sum of that of the entire number of cells. The resistance, however, is variable, and depends upon many factors. As already stated, the work to be done is to be counted as part of the external resistance. To this must be added the resistance of the conjunctive wire and electrodes; also that within the cell, or the internal resistance. Thus, where there are a number of cells connected in series, the amount of the resistance of each cell must be multiplied by the total number of cells in order to obtain the total internal resistance.

By electrolysis, chemical substances are resolved into their ions. The metals, alkaloids, and other bases seek the negative pole (cathode), and are called "cations"; the acids, iodine, chlorine, and sulphur, on the contrary, fly to the positive pole (anode), and are called "anions." Sudden reversals of the current produce a scattering of the ions, in place of their collecting at the poles. Now, if a solution of a salt be placed upon the human body and a direct galvanic current be made to pass through the solution and the body, the "cations" are carried along with the current into the tissues. This method of introducing chemical agents into the body is known as **foresis.** If the cations are carried into the body, we have the process of **cataforesis;** if the anions are sent in (by reversing the current), we have **anaforesis.** This has been applied to clinical medicine with excellent results; but in using foresis for therapeutic purposes, a careful note must be taken of the therapeutic effects of the two sets of ions. To illustrate, if, during foresis, potassium iodide be placed upon the body under the anode, this salt will be decomposed, the anions (iodine) will move toward the electrode close at hand, and the cations (potassium) will be driven through the skin into the body, replacing probably the sodium of the sodium chloride in the tissues and forming potassium chloride. If, on the contrary, the current should be reversed, the cations (potassium) would go to the electrode, and the iodine would be driven into the tissues. It is evident that the action will be most energetic in the immediate neighborhood of the electrode, and where the current density is greatest. The velocity with which the ions travel varies with circumstances, the strength of the current, size of electrode, their distances apart, etc. That they really enter the body is readily demonstrated by using a solution of quinine sulphate by cataforesis; the quinine will be found in the urine in a very short time. The therapeutic applications of this truly scientific method of administering remedies will be referred to shortly (page 970).

Electrical Dosage and Measurement.—This is not the place to go into the details of apparatus, but we may anticipate a little, in order to explain how the current-strength can be measured absolutely by the ampèremeter, milliampèremeter, or milliammeter. The resistance of a galvanic cell, or the total resistance of a battery, may be determined by adding to the external resistance (by means of apparatus constructed for the purpose, containing graded **resistance-coils)** until the current is reduced to one-half of its former strength, whence we learn that the added resistance just equals the original resistance, because the current-strength is always inversely as the resistance. If the current is taken directly from the cell, and there is no external resistance, then the added resistance just equals the resistance inside of the cell or battery. The internal resistance of any form of cell may thus be

measured by reducing the external resistance to a minimum, using a short and thick conjunctive wire of copper or silver, so that the external resistance may be ignored. After having measured the current-strength and estimated the total resistance, the determination of the electromotive force, or voltage, becomes a matter of simple calculation, since $E\ M\ F$ (voltage) $= C$ (in ampères) $\times R$ (in ohms). (For static, or franklinic, measurement see page 952).

In the foregoing reference to a combination of single cells to form what is called a "battery," it was stated that they are connected **in series,**—*i.e.*, the anode of one cell being attached to the cathode of the next,—the dissimilar plates or elements being thus connected together. If, on the contrary, we join all the poles of the same character,—*i.e.*, all the zincs and all the coppers, or carbons,—we have an arrangement known as a **parallel arc,** or they may be combined in sets, or **multiple arcs,** of five, ten, or any other desired number. The object of this arrangement is to reduce the internal resistance when the external resistance is small; but, as it also reduces the electromotive force, it is not a useful arrangement, **except where the plates are too small** for the work required. With cells suited to the purpose for which the battery is to be applied, this expedient is unnecessary.

Sources of Electrical Energy Other than Chemical.—Thus far we have considered only the cell as a source of electricity, producing what is called the galvanic, or battery, current. Other forms of electricity will now be considered; these are induced, or faradic, currents; friction, or static, currents; and magnetic, or dynamo, currents.

Faradic, or Induced, Currents.—The phenomenon of induction must here be considered before proceeding further. It has already been explained that an electric current is accompanied by a disturbance of the molecules of the surrounding media, which occur in "whorls," or lines of force circulating around the conjunctive wire. This is shown by the influence upon the compass-needle, which assumes a position at right angles to the wire bearing the current. If a coil of copper or iron wire be substituted for the magnetic needle, electrical phenomena will be excited and temporary currents started up whenever the circuit of the primary wire is closed or broken. These are more powerful if the primary wire be itself rolled into a spool or coil and placed inside of the secondary or induction coil. It is necessary to have the primary wire covered with insulating material, so that adjacent turns do not come in immediate contact with each other, and, also, to have it comparatively thick, so as to carry a large volume of current. On the other hand, it is of advantage to have the secondary wire (also insulated) of fine wire, so as to bring as many turns or coils of it under the influence of the lines of force at any given time, as is convenient. As the electromotive force (pressure, tension, or power of overcoming resistance) is **directly in proportion** with the number of coils of wire brought under the influence of lines of force (just as it is increased by the number of cells of the battery), it is evident that a fine wire in the secondary coil will yield a current of greater electromotive force than a coarse wire. In this way the apparent paradox is explained of a galvanic current without sufficient pressure to produce muscular contraction (because of the high resistance of the tissues), passing along a wire arranged in a particular manner, inducing a current in a secondary coil, of finer wire, and thus acquiring electromotive force or tension to produce both active muscular contractions and painful sensations.

Varieties of Quality in Faradic Currents.—The electromotive force, pressure, and intensity, or current-strength of a faradic current from a properly-constructed apparatus depends principally upon (*a*) the strength of the current carried by the primary coil and the size of the latter; (*b*) the actual number of convolutions of wire exposed to the influence of lines of force in the secondary coil when in action; (*c*) the suitability to the work of the wire composing and connecting the extremities of the secondary coil, or the coil to which the electrodes are attached. It is seen, therefore, that much depends upon the secondary coil, and the value of the connecting wire as a conductor. Many instruments are provided with connecting cords containing cheap, braided, brass wire, which is a poor conductor; well-insulated, flexible, copper wire is more suitable. Moreover, the secondary coil should have a large number of convolutions, and must, therefore, be made with fine wire; although, if too fine, it will impair its conducting power by introducing too much resistance. Finally, the flow of electricity through the primary wire should have sufficient volume for the work. Ordinarily, one small galvanic cell will be all that will be required to generate the induced current.

Mechanical Current-interrupter, or Rheotome—Neef's Hammer.—Since the currents in the secondary coil are only manifested at the times when the current in the primary wire is closed and opened, some device is needed to interrupt the current in the first wire. This may be done by any mechanical means, but the common method is that known as Neef's hammer. The principle upon which this is constructed is quite ingenious. Taking advantage of the fact that a current of electricity flowing along a wire arranged in a coil will cause soft-iron rods placed therein to become magnetic, although they immediately afterward lose their magnetism because soft iron cannot be permanently magnetized, we have the means of automatic interruption provided by passing the current through an automatic interrupter, which, at the moment when the current is flowing, is attracted by the magnetic coil, thus breaking the current. It is at once released when the current ceases to flow, and a spring carries it back to its original position, which at once makes the circuit again, and the process is repeated many times in a minute. The construction of faradic or induction batteries is essentially such as is here described, with minor variations in details of the apparatus.

Coarse and Fine Secondary Coils—Adams's Faradometer.—It must be remembered that the ordinary rules governing electrical phenomena hold good with the induced current, and that, while we have increased electromotive force by increasing the number of convolutions of wire **independently of the size of the wire,** the conducting power is inversely as the area of cross-section of the wire, and the current-strength is correspondingly reduced by using the very fine wire, because it offers greater resistance. This is the explanation of the muddle which some writers appear to have fallen into with regard to the relative utility of the coarse and fine secondary wire coils of a faradic battery. When large electrodes are employed, and only a small portion of the body brought into circuit (as where individual muscles are to be acted upon), or, in other words, when the external resistance is low, the coarse wire is more effective, because it has less internal resistance and the current is better balanced. On the other hand, where a large part of the body is to be acted upon or the electrical brush is to be used the external resistance is great, and better results are obtained from the fine coil—which has greater internal resistance, it is true, but also more electromotive force.

Sinusoidal Currents.—When a metallic circuit (such as one containing a coil of wire, wound on a soft iron armature, which revolves between the poles of an electro-magnet) revolves with uniform velocity, the current collected by the brushes is **sinusoidal**—the intensity of the current is proportional to the sine of the angle between the plane of the coil and the line of commutation. A similar current which does not change in direction is called an **undulating** current. The latter may be regarded, physiologically, as a combination of the sinusoidal with the continuous current, analogous to the combination of galvanic and faradic currents already mentioned. The frequency and amplitude of the undulations govern the physiologic action of sinusoidal currents. Below a certain frequency no muscular contraction results; then it begins, and increases regularly up to 1000 to 2000 alternations per second, when the added frequency ceases, and beyond 10,000 alternations per second muscular contractions cease altogether. With low frequency the best results are obtained from frequencies of 20 to 150 per second. Non-striated muscle responds in a most marked manner to the excitation of the sinusoidal current. It also appears to have a special action on sensory nerves, making it particularly useful in the treatment of certain forms of neuralgia. Slow alternations are most effective in the transport of ions. When the entire body is submitted to the action of these currents there is a general acceleration of the nutritive exchanges. D'Arsonval has shown that under this influence the blood absorbs 20 per cent. more oxygen than usual.[1]

Static Electricity.—The static, or friction, electrical machine is a familiar source of electrical phenomena; but within recent years great improvements have been introduced in the construction of these forms of apparatus which have made them useful and available for medical purposes. The principle upon which they are constructed is the old one of rubbing amber, or glass, with a non-conducting material, like silk. The ordinary form is that of a circular sheet or plate of glass, which is made to rapidly revolve in such a way that it is slightly rubbed with an exciting material, the glass and the rubber being insulated from each other and connected with the terminal posts, from which the current may be taken. The static machine for medical use contains several plates of large size, composed of glass or mica; and is run by electricity, water, or hand-power.

Electricity and Life-force.—Electrical units of measurement—the volt and the ampère—bear a fixed value and relation to other units used in measuring force, light, heat, etc. From what has already been stated, it is clear that the proper way to regard electricity is simply as a form of energy, which may be converted at will into other forms. As Hippocrates wrote, "There is no sacred disease, and all diseases are equally sacred," so we may say that "there is no mysterious force, but all forces are equally mysterious." The favorite statement of charlatans, that "electricity is life," is only true in the sense that heat and other forces are essential to life; but none of them can be correlated or transformed into life-force, about which—as of every other form of energy—we know absolutely nothing, except through its manifestations in connection with matter and physiological phenomena.

Electrical Measurements.—The relations of electricity to other forms of energy may be very briefly recapitulated. The prevailing system of measurement in science is based upon what is known as the Centimetre-Gramme-

[1] Guillemont, Electricity in Medicine, New York, 1906.

Second system of units, taking the units of length, the unit of weight, and the unit of time as the basis of calculation. The amount of force acting upon a gramme of matter so as to produce a velocity of 1 centimetre per second is the **Dyne**, or centimetre-gramme-second unit of force. The force exerted by gravity upon a gramme of matter at the level of the sea is 980 dynes; or, in other words, 1 dyne equals $^1/_{980}$ of the weight of a gramme at the earth's surface. Having determined the value of the unit of force, we next find that the unit of work, or energy, is the work done in exerting a force of 1 dyne over the distance of 1 centimetre, which is denominated the **Erg**, and is equivalent to $^1/_{7357500000}$ horse-power. For convenience in electrical calculations, which, with absolute centimetre-gramme-second units, would involve the use of numbers too large for daily use, the Electrical Congress adopted a series of conventional units, consisting of the **Volt**, the **Ampère**, and the **Ohm.** "The **volt** is equal to 100,000,000 ergs, or of absolute centimetre-gramme-second units of force, or 10 to the eighth power (expressed 10^8); the **ohm** is equal to 1,000,000,000 absolute centimetre-gramme-second units, or 10 to the ninth power (expressed 10^9)."

The unit of electrical power is the product of the pressure (electromotive force) of a current in **volts**, when multiplied by the volume expressed in **ampères.** The **Watt** is the term used to express this volt-ampère unit of electrical energy. It is equivalent to $^1/_{746}$ horse-power (746 **watts** equal one horse-power), from whence $\frac{E \times C}{746}$ = horse-power of any given current. A **Coulomb** is the working unit of electrical energy. When a current having the strength of 1 ampère passes through a 1-ohm resistance-conductor in 1 second of time, we have an **ampère-second**, or **coulomb**, of electricity. It is the unit of measurement of quantity obtained by multiplying the number of ampères by the time in seconds.[1]

The **Farad** is the unit of capacity. The prefix **mega** means an increase of one million times, and **micro** = $^1/_{1000000}$; they are often used in practical electricity. Thus, the capacity of submarine cables is usually about one-third microfarad per knot. A **Franklin** is the unit of static electricity (page 953).

Sources of Electricity for Medical Purposes.—The chief forms of apparatus for the generation of electrical energy now in use are:—

The Galvanic Cell.
The Faradic Cell.
The Static Apparatus.
The Magneto-electrical Machine, or Dynamo.
The Storage Batteries, or Accumulators.

Although the chief and most convenient sources of electricity for medical purposes at the present day are the commercial direct and alternating currents from the street-mains, made available for therapeutic application by means of a converter, or controller, and other forms of ingenious mechanism, yet the older forms of medical batteries, so called, are still largely employed. A brief description of the principal forms of these now in use will be necessary in order to understand their further application:—

Galvanic Cells.—Galvanic cells are supplied of various forms and combinations, but essentially they are alike, and consist of two plates (generating

[1] For these definitions the author is especially indebted to the very lucid exposition of the subject contained in "Electricity in its Application to Medicine." By Wellington Adams, M.D. George S. Davis, Detroit. In two volumes, 1889 and 1890.

and collecting) partially immersed in a fluid electrolyte, which acts chemically upon one (the positive, or generating, plate) and also conveys the current across to the other (the negative, or collecting, plate), as already explained. The great fault of such an arrangement as a source of electricity is that the current is not constant; it may start out with its full strength, but from various causes it soon declines to almost zero. This is found to be due to two principal causes: (1) so-called polarization of the negative plate, by bubbles of hydrogen clinging to the surface, and (2) chemical changes in the electrolyte, its action upon the positive plate making it progressively weaker; and it also offers more resistance to the current because more dense, owing to the formation and solution of a zinc salt. These objections to the single-fluid batteries have been overcome to a large extent by inserting a porous diaphragm between the two plates and immersing them in separate solutions; thus, in the two-fluid batteries, as they are called, the negative pole is placed in a cup of unglazed porcelain, which when moistened does not obstruct materially the passage of the current. The negative plate is surrounded by a solution which has a chemical affinity for hydrogen, and which acts as a "hydrogen-consumer," thus preventing polarization. As regards constancy, all chemical batteries will gradually run down, although some do so much more rapidly and less regularly than others.

Different Forms of Cells.—It has been found that certain forms are better adapted for medical purposes; and, as already explained, the battery must be especially selected for a particular kind of work. Some are made for cautery work, others for neurological and diagnostic purposes, and others still for gynæcological practice, or for charging secondary or storage batteries. Some are portable, others are stationary. The following are the principal forms in use:—

Single-Fluid Batteries.

The Grenet Cell.—Positive element, zinc; negative, carbon; electrolyte, dilute sulphuric acid containing chromic acid or potassium bichromate as a hydrogen-consumer. The advantage of this form of cell is that the zinc can be lifted, by a mechanical contrivance, entirely out of the fluid when the battery is not in use, or can be immersed to any desired extent according to the amount of the voltage that may be required. It is convenient for office work in connection with a faradic coil, or for running a small incandescent lamp. This form of cell is comparatively expensive and has not sufficient voltage for use when a part of the human body is in circuit, unless a large number of cells are used; very compact and useful portable batteries of this kind, however, are now constructed containing from ten to sixty or more cells, twenty-four to forty cells being well adapted for ordinary medical purposes, but not for gynæcological work by Apostoli's method. The solution used is known as the "electropoion" (or electric generating) fluid; it consists of 1 part commercial sulphuric acid diluted with 10 parts of water, to which, after it has become cold, add 1 part of finely-powdered bichromate of potash and dissolve by agitation. The late Dr. Carl Seiler recommended the addition of sulphuric acid to a concentrated solution of bichromate of potash, then, after the potassium sulphate has crystallized out, filtering off the solution, and subsequently adding sufficient water to bring it up to the proper proportion desired. By some, sodium bichromate is considered preferable to the potassium salt.

The Leclanché cell has zinc for the positive element, and originally a porous cup containing manganese dioxide and gas-carbon for the negative, with a saturated solution of ammonium chloride as the electrolyte; later forms, such as the Gonda and the Axo, substitute large blocks of gas-carbon for the porous cup. This has less electromotive force, but is remarkably constant and requires very little attention. It is in common use, on this account, for electrical bells and other purposes. Where a hundred or more such cells are combined, the voltage, although not great, yet is

sufficient for most medical purposes. There is no chemical action in this cell until the circuit is closed. It contains no acids or poisonous solutions (except that chloride of zinc is formed in it), it generates no corrosive vapors or offensive odors, does not freeze in winter, and only requires the occasional addition of water or fresh solution to replace that lost by evaporation. One charge of the solution will last from six or eight months to twenty-four or thirty, depending on the amount of use made of it. The Leclanché cell originally consisted of a cylindrical rod of zinc as a positive element, and a porous cell in which the negative element, consisting of equal parts of manganese dioxide and gas-carbon, was packed. In the course of time the negative element had to be renewed. Later forms of this battery, as stated above, simply substitute blocks of gas-carbon for the porous cup, which never need renewing. One form (the Law battery) is of this character and is of excellent construction, the cells being hermetically sealed by a cover, which prevents evaporation and creeping up of the ammonium salts. The electromotive force is 1.5 volts (1.35 according to Dr. Adams's measurement) and gives a current of 1 to $2\,^1/_2$ ampères *through a short circuit* or where the external resistance is small. This is the best form of open-circuit battery for medical use, according to Adams.

The Gravity Cell.—The positive element is zinc and the negative copper; the electrolyte, dilute sulphuric acid containing sulphate of copper in solution. This is a great improvement upon the old sulphate-of-copper battery, which polarized (ran down) very quickly. A large glass cell is employed, and the copper plate is placed at the bottom of the liquid, or near it, and upon it are placed some crystals of sulphate of copper. Near and just below the surface of the liquid is suspended a horizontal plate of zinc, armed with radii like the spokes of a wheel, in order to expose as much surface as possible to the action of the fluid. The greater density of the sulphate-of-copper solution keeps it at the bottom of the cell, around the negative plate, where it acts as a hydrogen-consumer; whereas, the sulphuric acid, liberated by the decomposition of the copper sulphate, ascends to the positive. The copper separates from the solution in metallic form, and is deposited upon the negative plate, while the crystals supply the place of that which was decomposed, and thus keep the solution saturated, making the cell continuous in its action. This form of cell is used for telegraph work, but is not used for medical purposes. It is very uniform in action, but has small electromotive force; it is generally worked with a closed circuit, while batteries for medical use are kept usually with an open circuit except when actually in use.

The Smee Cell.—Positive, zinc; negative, silver covered with platinum and with a rough surface to prevent adhesion of hydrogen; electrolyte, dilute sulphuric acid (1 to 20). This form of battery is almost obsolete in medical practice, although occasionally used in connection with the faradic coil. It has a high intensity, but is not constant. It is useful in the arts for electroplating.

Two-Fluid Batteries.

The Daniell element consists of a glass jar, or receiver, a positive plate of zinc, with a negative plate of copper, the copper plate being placed inside of the porous cup, which contains a saturated solution of sulphate of copper, the zinc being placed in dilute sulphuric acid in the containing jar. Some crystals of copper salt are placed in the interior of the porous cell, to keep the fluid saturated. The internal resistance of this cell is rather high, but is diminished by using large plates and placing them close together. It has an electromotive force of 1.05 volts, and is quite constant. A modification of this cell, by Siemens and Halske, of Berlin, was regarded by Remak as an improvement, but, according to de Watteville, is no longer used. The interior of the porous cell was packed with paper pulp, which, when wet with the solution, is a better conductor than the solution alone. It has been superseded by cells of higher electromotive force and of simpler construction.

The Grove Cell.—The generating plate is zinc; the collecting plate is platinum, the latter being immersed in dilute nitric acid (hydrogen-consumer), contained in a porous vessel, and the former in dilute sulphuric acid. The advantages of this battery are its high electromotive force (nearly 2 volts), its low internal resistance (usually less than $^1/_4$ ohm), and its simplicity. The objections are its cost, the corrosive fumes which it gives off while in use (nitrous acid), which attack the connections, and, finally, its want of constancy.

The Bunsen Cell.—This is the same as the preceding, except that a large piece of gas-carbon is made to replace the small platinum plate. The electromotive force is

even higher than the Grove; but the internal resistance is also higher, since carbon is not so good a conductor as platinum. In this cell the bichromate-of-potash solution may be placed in the porous cup instead of nitric acid, thus making it a double-cell Grenet.

Dry Cells.

The Chloride-of-Silver Battery of de la Rue.—Owing to the inconvenience of acids, an effort has been made to do away with them by substituting a paste made of flour and sulphate of zinc, in which the plates (chloride of silver, in the form of a rod, and two zincs) are permanently fixed and the cells hermetically sealed. Although the cells are small, they are able to produce decided physiological effects. The cells are only dry in the sense that they are permanently closed. They each represent an electromotive force of nearly 1 volt, and vary in internal resistance from 3 or 4 ohms to $^1/_2$ ohm, according to size. When used through proper external resistance, these batteries are applicable to many purposes. The chief objection is their high cost and the fact that, when exhausted, they can only be renewed by the maker or patentee. The commercial dry cells used for electric bells and for spark-coils are cheap and can be used for medical purposes, either for the galvanic current (using 20 to 30 cells), or for the induction coil (1 cell), or for illuminating a small electric lamp (4 to 6 cells, with a resistance coil) for diagnostic purposes. They require frequent renewal. The storage cells (4 to 6 cells) are largely used for the galvanic cautery. For most purposes, however, including Roentgen-ray work, the street current is utilized by means of a converter and controller.

The Care of the Battery.—In order to have the greatest efficiency, it is evident that the battery must be in good working order, the connections perfect, the electrolyte active, and the zinc clean. The best method of keeping the zinc with a clean surface is to amalgamate it with a little pure mercury. This is usually done by scraping away all foreign material with an old file and washing the surface with some weak acid solution (sulphuric or hydrochloric, usually); a little metallic mercury is now dropped upon the surface and rubbed over it with a brush or piece of rag attached to a stick. The zinc, when freshly amalgamated, shines like silver, and presents a uniform, amalgam-coated surface. When this is not done the current may be weakened and diverted by what is known as "local action." Small foreign bodies or impurities in the zinc, being electronegative to the zinc, set up little electric circuits and cause local action, which make holes in the plate and weakens the current proportionately. No rule can be given as to the time when the zincs should be amalgamated or fresh solution used; it depends very much upon the kind of cell and the amount of use, but, when the galvanometer shows that the battery is much below its proper efficiency, this attention may be needed to restore it.

Requirements of a Galvanic Battery.—Dr. Wellington Adams formulated the following as the theoretical conditions of a perfect battery:—

1. A high electromotive force.
2. A low and constant internal resistance.
3. A constant electromotive force irrespective of the current produced by the cell.
4. A consumption of inexpensive materials.
5. A lack of consumption of all material when no current is being produced; that is, when the circuit is not closed.
6. A ready means of occasionally examining its condition and working and of adding fresh materials when required.

Work of a Galvanic Battery.—It should always be borne in mind that the electromotive force of a galvanic cell is independent of its size, a cell no larger than a thimble possessing the same electromotive force as one the size

of a barrel **where the elements are the same.** The character of the elements, therefore, determines the electromotive force, or the tension, of the current, all cells having similar elements possessing the same difference of potential. Moreover, one cell will yield the same quantity or volume of current on a short circuit, theoretically, as a hundred, and no more electricity can be obtained from the latter than the former on a **short circuit** (no external resistance). But one hundred cells arranged in series will have a hundred times as much electromotive force, or power of overcoming resistance. Finally, the strength of a current which any cell will give is largely affected by its internal resistance, this depending upon the size or extent of surface of the elements, their proximity, and the character of the solution and of the negative plate, as conductors, and the amount of chemical action. The **pressure,** or **electromotive force,** depends upon difference of potential, while the **quantity** of electricity depends directly upon the chemical action upon the positive plate; the **current-strength** is the resultant of these two factors.

Galvanocautery.—For galvanocautery work, large Grenet cells may be employed. In this case, the external resistance being small, the conjunctive wire being short and a good conductor, everything is gained by increasing the size of the plates and bringing them close together, thus diminishing internal resistance and balancing the battery. Polarization may be prevented by agitating the liquid, or other means. From four to six cells of rather large size are sufficient. A very good mechanical arrangement has been devised, by which the zincs attached to a frame are raised or lowered by pressing a lever or treadle with the foot; by this means the battery is only in use for a short period at a time, and polarization has less time in which to take place. The storage battery is also used for galvanocautery work. (See **Storage Batteries.**)

Faradic, or Induction, Apparatus.—The construction of this very useful form of apparatus has already been explained and the theory of its action considered, by which currents of high electromotive force and small quantity are obtained from those of low electromotive force with relatively large quantity. Usually a dry cell or a small Grenet is used as a source of electricity, which flows along the primary wire. As already stated, the second coil should consist of a large number of spiral turns of fine wire, each insulated from the other; but an extra coil of coarser wire may be used when the external resistance is small. The currents induced by the making and breaking of the circuit in the primary wire, by clock-work rheotome, or by the action of the automatic interrupter are of momentary duration and opposite in direction. In the wires connecting the extremities of the secondary coil, in ordinary medical batteries, therefore **on a short circuit,** there is, properly speaking, no direction to the currents; they are rapidly-reversing to-and-fro currents. At the same time, they are not of equal strength, and, if the resistance be great, the current set up upon closing the circuit is unable to pass around, and only the current set up at the time of breaking the circuit is left, which, of course, will be in one direction. Moreover, if the interruptions are sufficiently rapid it will be practically continuous. It has already been pointed out that, by a device known as a commutator, the first current may be reversed so as to reinforce the other; but this is not usually found in a medical faradic apparatus. The poles of such a faradic apparatus, may, therefore, be properly marked + and — (or positive and negative), if the currents are all in one direction. In addition to the extra or induced

currents set up in the second coil, there are similar induced currents in the primary coil, as its electrical equilibrium is disturbed by the making and breaking of the circuit. If connections are made with the ends of the primary coil this (which is generally, though incorrectly, called by instrument-makers "the primary current") may also be utilized in medicine. The current from this coil differs in several features from the current from the second coil: 1. Owing to the fact that fewer lines of force are involved, the **intensity,** or **electromotive force,** is much less than in the latter. 2. As at the moment of starting the current the circuit through the cell is shorter than through the electrodes, the first induced current passes through the cell, leaving the second only to pass along the rheophores; therefore it is an interrupted induced current, all in one direction, and not a to-and-fro current. 3. The current is increased in intensity by inserting a bundle of soft-iron wire in the interior of the coil, or by bringing the secondary coil over it, just as the secondary current is increased.

Number of Currents from a Faradic Battery.—Some batteries give only the current from the second coil; some give, in addition, the extra current from the primary coil. The only current of real general utility is that from the coarse and fine secondary coils, having a high electromotive force and small quantity. This is capable of passing through a high resistance, such as that offered by the tissues of the human body: a resistance which would require from sixty to eighty cells of a galvanic battery, arranged in series, to overcome. From this it is seen how futile it is to expect to obtain a galvanic current for medical purposes from the cell or cells accompanying the ordinary faradic instrument. Therefore, medical batteries professing to give, in portable form, both galvanic and induced currents, so as to suit all cases, will not fulfill the requirements of practice. Physicians find it necessary to have both a faradic and a galvanic instrument, or several of different kinds, suited to different cases. With regard to a variety and combination of coils and their effects, we may quote from an article on "The Different Physiological and Therapeutical Properties of the Induced Currents of Electricity,"[1] by Dr. A. D. Rockwell, who summarizes his conclusions as follows:—

1. From the continuous-coil apparatus, owing to its combination of helices, the wires of which differ in thickness and length, proceed four qualities of current that vary in a most remarkable degree in all the properties of electricity: physical, physiological, and therapeutical.

2. That the variation is observed most markedly when applications are made internally to the vagina, uterus, rectum, or bladder, by the bipolar method.

3. From the primary or first induction coil we obtain a current of quantity that is barely perceptible externally, but internally, and especially by the bipolar method, acts with greatly increased efficiency.

4. From the combination of the primary and secondary induction coils we obtain a current of greater tension, but which still acts mildly when applied externally. Applied internally, however, its effects are far greater than the first coil, both in exciting the sensibility and contractility, and the utmost caution must be exercised in its use. In the same degree, also, it acts upon the vagina, rectum, bladder, and testes. This current is especially applicable

[1] *Medical Record*, Feb. 14, 1891.

in the treatment of enlargements of the uterus due to subinvolution, but is of little or no value when the enlargement is due to fibrous tissue. It is of especial value in post-partum hæmorrhage, and, from its power to excite the sensibility and contractility of the bladder and rectum, it may be used with good effect when these organs are anæsthetic, or suffer from diminished or lost contractility.

5. From a combination of the first, second, and third induction we obtain the maximum power to excite both sensibility and contractility on the external surface of the body, each additional coil simply giving a decreasing power over sensation and contraction. Applied internally, however, it acts far less powerfully than either of the two previously-named currents; but in the ordinary forms of paralysis of voluntary muscles it will more readily call forth contractions than the current from any other combination of coils.

6. From the first, second, third, and fourth induction coils combined a current is obtained differing from and superior to all the others in its sedative and general tonic effect upon the system at large. It neither acts upon the sensibility nor muscular contractility when applied externally, as does the third current of the series; nor with a tenth or even a twentieth part of the acuteness, when applied internally, that characterizes the second current of the series. For the purpose of general faradization, however, it is the only proper current to use, and for applications to the vagina and uterus, for the relief of many forms of pain, it possesses properties that are invaluable.

Rapid and Slow Interruptions.—All faradic batteries are now provided with some form of the magneto-electric, automatic interrupter; although the rheotome, or current-breaker, may also be governed by clock-work, by the hand, or any other convenient method. Ordinarily, the interrupter, or rheotome, is attached to a spring, as already described, and the interruptions occur with such rapidity as to make a buzzing sound or even a musical note. An improvement upon this is found in some first-class instruments, which enables the operator to increase the interval at will between the shocks, according to the case. In some patients the muscles are thrown into tetanic spasm by very rapid interruptions, and here the slow interrupter is of great service.

Size of Instruments.—Faradic batteries are made of different sizes and various shapes. For treatment of cases of poisoning, or in obstetrical practice, and, in fact, in many medical cases, the small case, such as the Gaiffé, or one of its modifications and imitations, may be all that is required. But for diagnosis and general clinical use, a better one, provided with slow interrupter and a large secondary coil, is indispensable, such as is provided by Otto Flemming, the Galvano-Faradic, the McIntosh Company, and others.

Combined Currents—Galvano-faradization.—No real advantage is obtained by combining the primary and secondary currents in the faradic apparatus; but de Watteville and others have combined the galvanic and faradic currents in order to give greater volume to the latter, and enable it to penetrate more deeply into the tissues.

The Static, or Franklinic, Apparatus.—This is the oldest form of electricity known. It is exhibited when a piece of glass is rubbed with resin, or when vulcanite is rubbed with silk. Now, if either the glass or the resin be brought in the vicinity of some small pieces of paper, or other light objects, phenomena of attraction and repulsion will be manifested. This

condition is known as electrification; and it has been found, from various experiments, that:—

1. Articles attracted by the glass are repelled by the resin, and those repelled by glass are attracted by the resin; hence the theory that there are two kinds of components of electricity, called, for convenience, a positive and a negative.

2. Many other bodies, when rubbed together, produce similar phenomena, and become either electropositive or electronegative.

3. Articles which give electropositive electricity when rubbed with one excitant may give the electronegative electricity when rubbed with something else; so that the form of electrical disturbance depends upon the relations of the bodies which produce it. For instance, glass, when rubbed with resin, produces electropositive phenomena; when rubbed with fur it is electronegative.

4. The electrical conditions of both articles are disturbed, and to an equal extent, the quantity of electricity upon the glass rod being exactly equaled by that on the resin or fur.

5. The amount of electrical difference between the two bodies is known as "the difference of potential," since it is the measure of the force which would have to be exerted in order to restore them to their original state of equilibrium.

6. Electrical phenomena are produced in bodies brought into the vicinity of either a positively or negatively excited electrode. This is induction, and the electricity thus caused is known as induced electricity. It is found that, under such circumstances, in a body capable of conducting electricity, the form of electricity will be contrary to that of the electrode, and they will be mutually attracted. Hence the rule: "Unlike electricities attract, like electricities repel, each other."

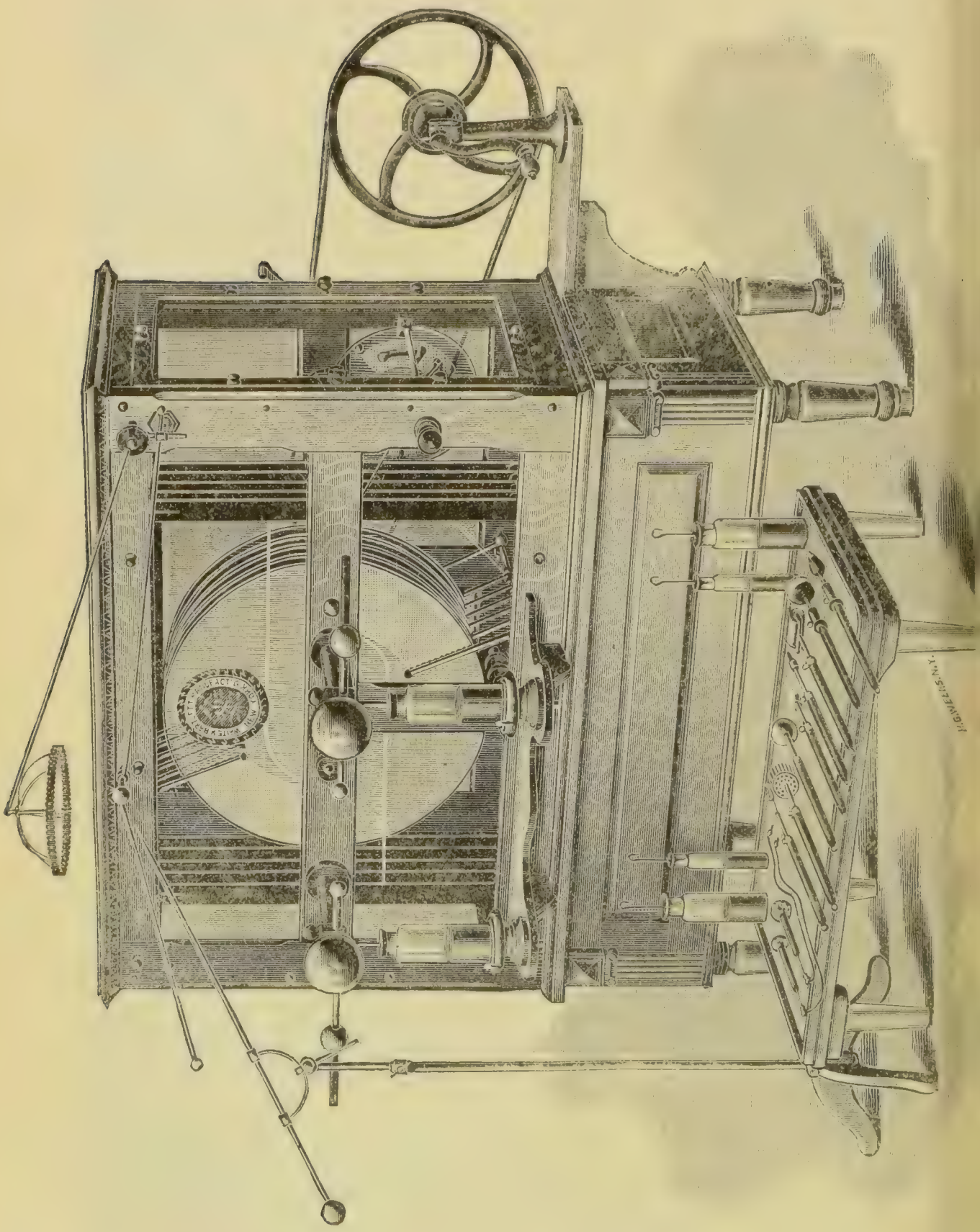
7. Electricity of this character is confined to the surface of bodies, and can be confined or stored up in appropriate apparatus,—*i.e.*, in what is known as the Leyden jar,—and is, therefore, known as "static electricity."

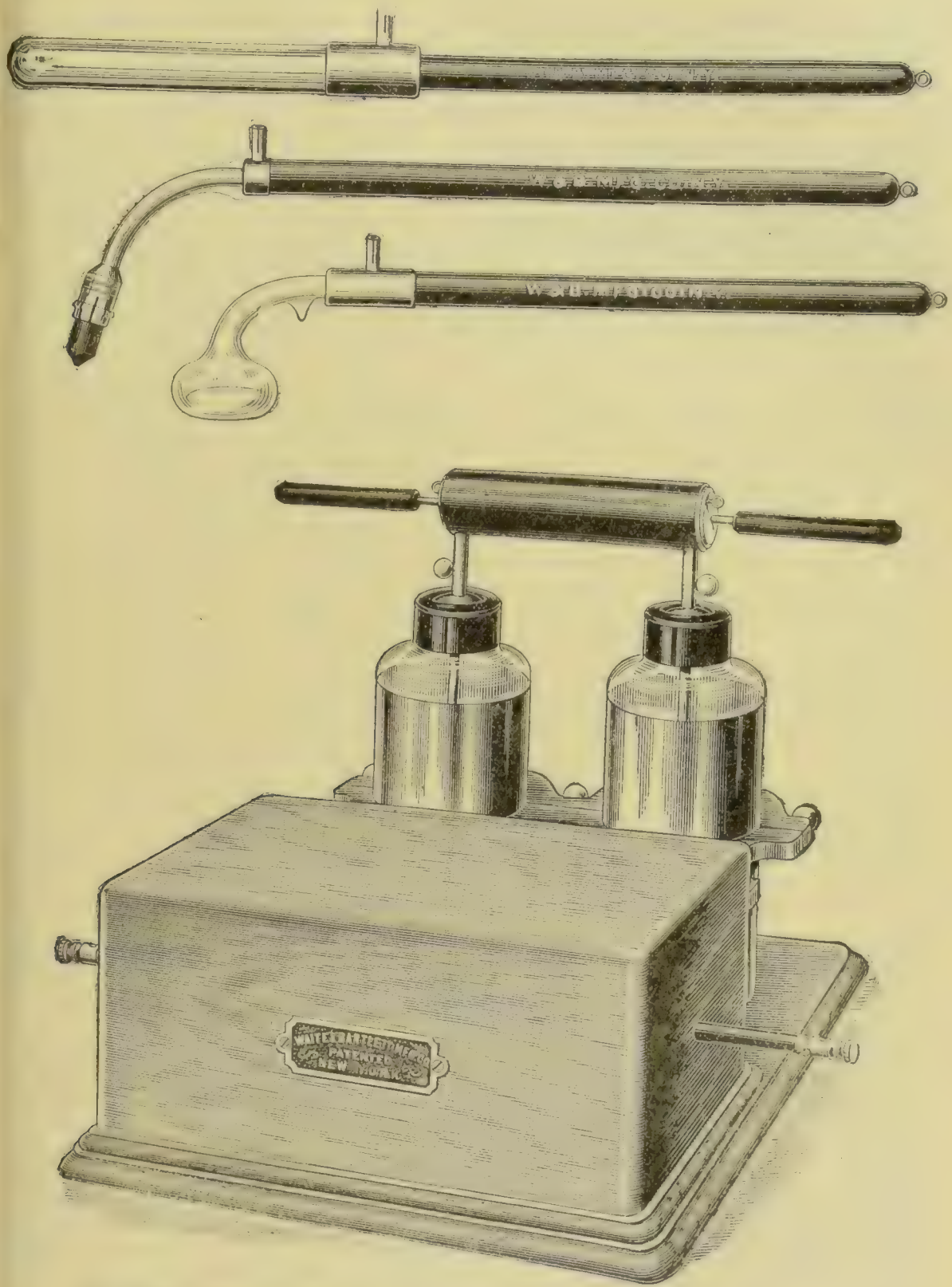
8. A body is charged by conduction when its electricity is conveyed to it through a rheophore or metallic connection. It is said to be charged by induction when the electricity is due to the action of surrounding bodies without contact, as already explained.

9. The phenomena of static electricity resemble and are identical with electricity from other sources, when of small quantity and exceedingly high tension (or electromotive force). The terms positive and negative, therefore, resolve themselves into differences of potential, the current flowing from the higher to the lower potential, as in the current from the galvanic cell.

The foregoing brief *résumé* of the phenomena of static electricity is a necessary introduction to the study of electrostatic machines. They consist, essentially, of an apparatus designed to convert motion into electricity by means of friction and induction.

Forms of Static Instruments.—Electrostatic machines are either **frictional** or **induction** machines, the latter requiring to be independently charged before they will act. Frictional machines are identical in principle with the experiment first mentioned, where glass was excited by rubbing. In its usual form the glass is a circular plate or disk suspended from its centre, and capable of revolving when turned by a crank. It is provided with a rubber or cushion of leather covered with amalgam of tin and mercury, this be-





The Piffard Hyperstatic Transformer. (See diagram on next page.)

By connecting the transformer with a static machine the current undergoes a complete change, rendering its application painless even when applied to the most sensitive organs. As the current is of higher voltage than that of the static induced, the spark from one pole only is, as a rule, used, employing either a metal or carbon point, or else the glass tube lined with tin-foil (see diagrams at top of page). The effect of the hyperstatic spark on eczema and acne and in some cases of local pruritus has been extremely gratifying. In various forms of neuralgias, where irritation is wanted, any resisting medium interposed between the high-tension spark and the skin (such as covering the lesion with oil) will produce increased pain and irritation. One is able, therefore, by regulating the spark-gap between the jars, and using oil or not, as may be required, to obtain either an absolutely painless and almost fugitive effect, or, on the contrary, produce a very marked cutaneous reaction.

ing slightly pressed against the side of the plate, so as to cause friction when the plate is revolved. There is also a comb of metal, the points of which do not quite touch the surface of the plate. The cushion and comb are connected by means of metallic conductors, each with one of a pair of brass balls, which are the poles or electrodes of the apparatus. When the glass disk is revolved the rubber excites positive electricity upon the glass surface, and is itself negatively excited; owing to the amalgam, its charge is carried to the electrode in connection with it. The surface of the glass which is positively excited passes under the comb, which conducts the charge of positive electricity to the brass ball corresponding with it. The charge of positive electricity steadily increases, until the difference of potential is so

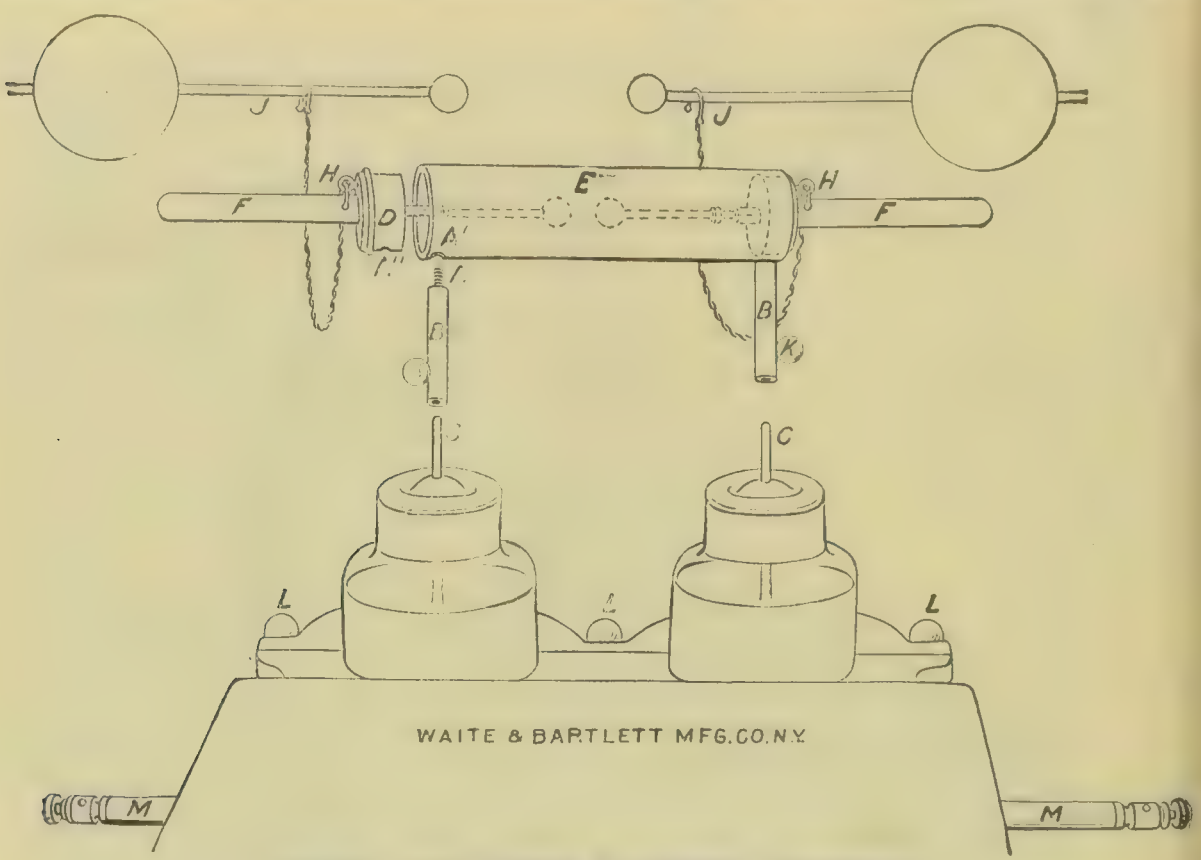


Diagram of the Piffard Hyperstatic Transformer.

J, J, Poles of static machine. *F*, Muffler for concealing spark and suppressing sound. *F, F*, Spark-controllers. *H, H*, Connectors with static. *D, D*, Removable ends of *E*. *A''*, Screw-hole. *A'*, Screw-hole. *A*, Screw for *A''* and *A'*. *B, B*, Arms for connecting *C* and *C*. *K, K*, Screws for tightening *C* and *C*. *L, L, L*, Screws for holding jars. *M, M*, For cords and electrodes. Directions: Connect the poles of your static machine with the muffler at *H, H*, this by the tubes with the projecting arm of the jars (*C, C*), and regulate the strength of the discharge by the spark-controllers.

great as to cause a disruptive discharge between the two poles. This temporarily restores the equilibrium of the glass, which passes again under the rubber and the phenomenon is repeated. The pole in connection with the comb which is positively excited will, if brought near the negatively-excited pole, discharge itself as a spark passing between the poles, when the difference of potential is sufficient to enable it to jump across the intervening space. If it is desired to apply this form of electricity to medical purposes, light brass chains or other conductors are attached to the poles, and by means of suitable electrodes sparks may be drawn from different parts of the human body. If we insulate the patient by seating him upon a chair having glass castors or a stool supported by glass, we may connect him with either pole,

the other pole being grounded, and he will then become stored with either positive or negative electricity, and sparks may be drawn by bringing the opposite electrode, or any object by means of which communication may be had with the earth, near him. Other applications besides this so-called electric bath will be mentioned farther on.

The Holtz Machine.—The improved Holtz apparatus is regarded as the best of the induction, or influence, machines. It consists essentially of two varnished-glass disks, one being stationary, the other revolving. The stationary plate has two apertures, through which project the ends of two strips of paper, called **inductors**, which are attached to the outer side of the plate. The free extremities of these inductors emerge upon the inner side opposite a pair of metal combs, each connected by a metal rod and by a conductor with one of the poles. The action of the machine is thus explained: "Let one of the inductors be charged,—say, positively,—and let the two electrodes be brought into contact. As a result, the comb opposite the inductor is charged negatively by induction, and a positive charge appears at the other comb, since the combs are in communication through the joined electrodes and the positive electricity is repelled away from the inductor itself. Since the combs consist of sharp points, the negative electricity upon the first comb begins to discharge itself against the glass plate in a direction toward the other inductor and comb. Both of these, therefore, discharge positive electricity on the plate,—the comb upon one side, the inductor upon the other,—while the inductor itself receives a negative charge. Clearly, therefore, a part of the negative charge upon the front of the plate is neutralized, and the positive charge upon the back is carried around again toward the positive inductor. This increases the action of the positive inductor, since the inductor itself discharges negative electricity upon the plate and becomes itself more and more strongly electrified positively. If the electrodes are now separated sparks will pass between them"[1] when the plate is made to revolve. The object of having the holes in the stationary plate is to diminish the capacity of those parts of the plate which are opposite them, and thus cause them the more readily to give up some of their charge. In some cases Leyden jars are attached to the electrodes, the object being to increase the energy of the sparks given off, and, in fact, make it resemble in its effects the faradic current.

Magneto-electricity and Dynamos.—The fact that a magnet introduced into the interior of a coil of wire is capable of disturbing its electrical equilibrium and instituting electrical impulses has led to the construction of medical electrical machines, in which coils of wire, attached to a revolving frame, are made to pass rapidly through the lines of force around the poles of a large magnet. Currents are set up in the coil as it enters and as it leaves the magnetic field, and by proper connections these currents are conveyed to electrodes, by which they can be applied to the body. These currents are of high tension, but of feeble quantity—resembling, in this respect, the faradic machines, which are much more efficient and convenient, so that they have driven the others out of use. Within a few years, however, improvements have been made in the construction, and large magneto-electrical machines are made, which are run by steam and are called dynamos. They are now

[1] Liebig and Rohé, "Practical Electricity in Medicine and Surgery," p. 27. The F. A. Davis Company, publishers, Philadelphia, 1890.

employed in electric lighting, and as a source of power for many purposes. The wires carrying these currents in the street-mains have been utilized as a source of electricity for medical purposes, and we may briefly refer to the subject here. There is a distinction of great importance to be observed between the currents supplying the arc light and the incandescent light; the former requires a 10-ampère current, with electromotive force of about 60 volts, while the latter has something like $^1/_2$ ampère, with an electromotive force of 110 volts. Owing to this difference in quantity and pressure, it is easily seen that their utility for medical purposes varies greatly. The arc-light current is capable of causing fatal results, while no serious result would follow the use of the incandescent (Edison) current, **unless the conductor was accidentally connected with an arc current flowing in an arc-light wire,** in which case its current would be immediately increased, and, unless protected by a previous insertion of a fusible plug in the circuit before reaching the patient, serious results might follow. Where an arc current only is available, it is conducted through what is known as a "converter," which is essentially a coil of wire surrounded by a secondary coil, from which the induced current, having higher intensity and less quantity, is obtained just as in the faradic apparatus. It is not necessary to discuss the construction of motors and dynamos, nor the different methods of arranging the wires in the armatures, in order to obtain currents of higher or lower potential.

For these details the reader is referred to Liebig and Rohé's work on "Medical Electricity," to which reference has already been made, and other monographs on medical electricity, electric lighting, etc. Small dynamos have been constructed for use in clinical work, but they are expensive, unreliable, and unsatisfactory, when compared with galvanic and static machines now furnished. The electric-light current may be utilized for running small motors for dental drills or nasal instruments, and the static machines; and, by the use of resistance-coils, it is made applicable to all medical purposes. It is also made available for medical use as a source of electricity, through Faure's invention of the storage battery, in which the current is completely under control.

Storage Batteries, or Accumulators.—While the Leyden jar, one of its modifications, is the only means, strictly speaking, for accumulating electricity, the name of storage battery has been, by general consent, applied to a form of apparatus in which chemical action produced by a current of large volume and low pressure is utilized to yield, at will, a current of low volume and large electromotive force. The form known as the Planté cell originally consisted simply of two insulated plates of lead immersed in dilute sulphuric acid. If, through this apparatus, a current be passed for a certain length of time, it will be found that certain chemical and physical changes have taken place, and one plate is seen to be covered with a layer of oxide of lead. Now, if the current be reversed, the other plate will become oxidized, and the first plate will be deoxidized and again become metallic lead, but the surface will be converted into a spongy condition. The plates are now said to be "formed," the spongy lead being the negative plate and the oxidized the positive—the current, in other words, flowing from the plate containing the oxide through the circuit, or conjunctive wire, and into the cell through the spongy plate. During the process of charging the cell the current is made to flow in the opposite direction—into the cell through the positive plate, and out through the other. After charging, the positive plate is still more

oxidized. Subsequently, when the circuit of the cell is closed, a current is set up, which continues as long as there is sufficient difference in potential between the plates to overcome the resistance, and during this time the positive plate becomes progressively less and less oxidized, and the negative more. In the present form of the Faure cell the lead plates are cast in molds, which give the plates a peculiar shape. They are called "grids," because they contain numerous holes or perforations, which are filled with oxide of lead, mixed into a paste with sulphuric acid. Two oxides are employed,—the red oxide (Pb_3O_4) for the positive plate, and yellow oxide (PbO) for the negative. After the plates have been thus prepared they are "formed" by passing a current obtained either from the electric-light main or battery, of proper intensity, through them, when immersed in dilute sulphuric acid. When several storage cells are used, they are always coupled in parallel, the positive plates all being joined together by a lead strip, and the negatives similarly united. In this way each additional cell proportionately diminishes the internal resistance. The storage cell is largely used in medicine and surgery, in connection with the galvanocautery; dental engine, or drill; and electric light for exploratory purposes. It is usually found convenient to use from four to six cells. They may be charged either from a large galvanic battery (sixty to one hundred cells) or from the Edison incandescent electric-light current. Storage cells each represent an electromotive force of about 2 volts. When in use, as soon as the electromotive force falls to 1.8 or 1.7 volts, the battery should be disconnected and **at once** recharged. It should not be allowed to run down further than this, and should not be permitted to remain, when not in use, in an uncharged state, for it will lose in efficiency if neglected. The capacity of a storage battery is usually indicated in ampère-hours: that is, by the number of hours it will furnish a current of given intensity. A battery with a capacity of 100 ampère-hours, theoretically, will furnish a current of 10 ampères for ten hours, or of 5 ampères for twenty hours, etc. In practice, however, the capacity diminishes with the intensity of the current; so that the above battery might furnish 25 ampères for only three hours, instead of four, or 50 ampères, possibly, for only one hour, instead of two. The size of the cells and their number are made to correspond with the particular work they are intended to perform, as the best work can be done only when a battery is discharged at its "normal" rate: that is, the kind of work that it was made for. The cells may contain a number of plates, thus greatly increasing the surface exposure and diminishing the resistance. The objection to storage batteries is their weight; but recent improvements have been made by which both the weight and cost have been materially reduced.

Electrical Apparatus Other than Batteries—Electrodes, etc.—In addition to a source of supply of electrical energy for medical use, certain apparatus is needed. The rheophores, or current-carriers, have already been mentioned. The electrodes, or poles, are of different shapes, adapted to the part of the body they are intended to be applied to. As metallic electrodes cause pain when strong currents are used, it is customary to cover the electrode with a moist sponge or leather; what is better is a layer of absorbent cotton, and moistened with salt-water because it is a better conductor than plain water. Where large-volume currents are used it is necessary to increase the size of the electrode in order to avoid electrolysis of the tissues; for instance, in the Apostoli method one of the electrodes is made of a mass

of clay applied over the surface of the abdomen, while the other, being comparatively small, is usually made of carbon, and is applied so as to produce the desired local effect upon the uterine structures. Electrodes for cautery purposes are usually made of platinum, in the form of loops of wire of different sizes, according to their destined purpose. The wire may be used as an écraseur, and heated to the desired degree by the current as it cuts its way through; but much tension cannot be put upon a wire that is heated, because it is soft and less able to resist when in this condition. The electrodes ordinarily employed for the percutaneous method of administering electricity are of great variety of shapes, varying with the taste of the user. They may be double, each pole being insulated until joined by some object, such as the mucous membrane; these are used for intra-uterine, laryngeal, or eye work. A similar electrode is used as a searcher for bullets, an electric bell being placed in circuit, which rings when metallic connection is made.

Galvanometers, Milliamperemeters,—the Dynamometer, Coulombmeter, and Electrodensimeter.—Besides batteries and electrodes, an instrument for measuring the quantity or intensity of a current is needed. The galvanometer is constructed upon the principle of the deflection of a magnet, by the passage of a current of electricity parallel with it. A magnetic needle surrounded by a coil of insulated wire will be deflected from its usual position in relation to the earth's magnetism (north and south) and made to revolve more or less to a position approximating a right angle; the greater the strength of current, the greater the deflection, although not directly related, since doubling the current does not double the amount of deviation. As the galvanometer is marked in milliampères, it is commonly known as the milliampèremeter, or, abbreviated, simply milliammeter. Such an instrument is called direct reading if it indicates at any moment the strength of current in ampères. Very good instruments are made by Waite & Bartlett, Flemming, and by McIntosh. Wellington Adams pronounces in favor of the Weston milliammeter. For exact measurement of electrical work a **coulombmeter** is used, which depends upon the amount of decomposition or electrolysis taking place within a certain time while the battery is in use. An instrument of this kind is used in connection with the electric lamps, to discover at stated periods exactly the quantity of electricity which had been used. Besides these, practical electricians make use of another instrument, known as the **dynamometer.** In this instrument the amount of attraction between coils of wire, carrying currents in the same direction parallel with each other, is measured by the amount of angular deflection. In the dynamometer, instead of a magnetic needle, we have a coil of wire to be acted upon. When the current is reversed it is changed simultaneously in both coils, and the same effect is produced as when the current was constant; hence, with this instrument, we may measure the strength of alternating currents, which could not be done with the ammeter. The deflection of the dynamometer is proportional to the product of the two currents; consequently, in order to determine the strength of the current itself, it is necessary to take the square root of the amount of the anterior deflection of the suspended coil.

Measurement of the Dose of Static Electricity.—Benoist has devised an instrument, which he calls an electrodensimeter, for measuring the dosage of static electricity. He describes it[1] as an aluminum-leaf electroscope,

[1] *Archives of the Roentgen Ray*, June, 1905.

which is graduated both in degrees and in absolute units, or "franklins," per square centimetre. The capacity of the electrometer can be varied by means of a second movable disc parallel to the first, and so regulated as to be equal to that of a sphere of ten centimetres radius. Each franklin will raise the potential of the electrometer by 10 C. G. S. units of potential (or $10 \times 300 = 3000$ volts). The divergence of the aluminum leaf may be read off directly in franklins on the divided quadrant attached to the electrometer.

Benoist places his patient on an insulated stool connected with an electrostatic machine. The subject is now assumed to be covered with a layer of electricity in mobile equilibrium. The density of this layer, or the quantity in each cubic centimetre, is the factor which determines the physiologic and therapeutic effects of the electrostatic bath. To measure this density, he makes use of a proof-plane, consisting of a small metallic disc, with an insulating handle. The back of the outstretched hand being touched with this instrument, the latter is charged with the same electric density as appertains to the patient. If the proof-plane be now applied to an aluminum-leaf electroscope of known capacity, such as Benoist's electro-densimeter, the charge will be distributed over the whole of the condenser plate, and may be measured by the extent of the repulsive action on the aluminum leaf. With an ordinary electrostatic machine, the patient will be charged with from 5 to 15 C. G. S. units per square centimetre. The difficulty of defining a C. G. S. unit led Benoist to suggest in its place the term "franklin." A **Franklin** of positive electricity at a distance of one centimetre from another franklin of positive electricity repels it with the force of one dyne, which equals about one milligramme in weight. A franklin equals one-third of a micro-millicoulomb (the coulomb being the practical unit of current electricity, or the amount passing any point in a circuit, carrying a current of one ampère). The term frankln is proposed as the absolute unit of electrical quantity, franklinization being already used for the medical application of static electricity. Electrical density, under these circumstances, then, would mean so many franklins per square centimetre. An electrical bath, therefore, may be prescribed as a bath of ten franklins, the patient in this case receiving the exact dose equivalent to a density of ten C. G. S. units per square centimetre on the back of the outstretched hand.

Different Forms of Rheostat for Determining Resistance.—A form of apparatus for accurately measuring resistance, or **ohmmeter,** consists of a box containing a number of coils of wire, the resistance of which is definitely known, which can be introduced into the circuit either in connection with the unknown resistance or in substitution for it, the latter being a more direct method. This apparatus is known as the "Wheatstone bridge."

A **rheostat**—consisting of a column of water in a glass tube, or a series of resistance-coils, or a mass of plumbago,[1] as in the Massey current-controller—is almost indispensable in using the galvanic current, since by its means the entire battery of forty to eighty cells is brought into action at once, the current being gradually raised from zero to the desired amount and afterward lowered again before removing the electrodes.

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[1] A plumbago current-controller was patented by Dr. John Butler, author of "Electro-Therapeutics and Electro-Surgery," Philadelphia, 1879 and 1882.

Labile and Stabile Applications—Ascending and Descending Currents—General Faradization and Galvanization.—When the electrodes are kept upon certain spots, the application is said to be "stabile"; when they are moved about, it is a "labile" application. When the poles are so placed that the current passes toward the periphery, it is said to be **descending**; when reversed, it is **ascending**. This applies both to the faradic and galvanic currents. In general galvanization a moist foot-plate or foot-bath may be attached to the negative electrode, while the positive, covered with wet cotton, is held to the forehead or occiput. The caution is given by most electro-therapeutists not to use very strong currents if the head is in the circuit, nor to abruptly make and break or reverse the current; nor should the application be kept up for a longer time than five to eight minutes. General faradization is accomplished by applying one electrode to the spine, in the cervical or dorsal region, and passing the other rapidly over the surface of the extremities. It is often, and very advantageously, combined with massage.

Rheotome.—A mechanical device for interrupting the galvanic current is called a rheotome, and is an indispensable part of the outfit, as furnished by the principal manufacturers. The slow interruption may be made mechanically,—by the hand or foot or by clock-work,—but the automatic interrupter is most commonly used. The same result may be accomplished, though less satisfactorily, by brief applications, simply "dabbing" one electrode on the part, the other being stationary.

Current-collector, or Pole-board.—In a complete battery outfit it was formerly considered absolutely necessary to have what is called a **collector,** which represents the extremities of the wires communicating with the cells, so that by simple movement of a switch any number of cells are thrown into circuit. The simplest form of collector is in the shape of a dial, consisting of a single row of metal buttons arranged in a circle. In the centre is a metallic post, which has a movable arm which swings around the circle, bringing into action as many as are required, the buttons having a circle of numbers just outside of them corresponding with the number of cells. If the arm of the dial-collector be sufficiently wide to touch two adjoining buttons, breaking the current will not occur when the arm is moved from one to another. With a large battery two dial-collectors are employed,—one representing single cells, the other accessions of two, three, or five cells. Since the introduction of the milliammeter and the rheostat, or current-controller, the necessity for a pole-board collector is much less imperative, and it may be entirely dispensed with without inconvenience.

The Current-reverser.—The **commutator,** or pole-changer, is also a valuable, if not indispensable, adjunct to a good battery. It is a mechanical contrivance, by means of which the polarity of the electrodes may be reversed without changing their position. This may be done by a simple switch; but, where rapid reversals are required, the best form is a split button. The revolving shaft carries a disk bound with brass, in which there are two interruptions of continuity, or vacant spaces. Upon the circumference four flexible metallic connections impinge, so that, as the handle is turned, the poles are brought alternately in connection with each electrode. The ordinary pole-changing switches have adjustable contact-springs beneath the levers, which make close contact with the buttons beneath, the surface of which should be kept clean and bright. By employing two pole-changing

switches, one connected with a galvanic and the other with a faradic battery, the change may not only be made from one polarity to another, but also from the chemical to the induced current, without removing the electrodes. Such a switch-board, as first devised by de Watteville, and known as a "current-alternator, reverser, and combiner," is manufactured by the Waite & Bartlett Company.

Some Points with Regard to Electrodes.—With regard to electrodes, Erb recommends the following standard sizes:—

1. Fine electrode, $^1/_2$ centimetre ($^1/_5$ inch) in diameter.
2. Small electrode, 2 centimetres ($^3/_4$ inch) in diameter.
3. Medium electrode, 5 centimetres (2 inches) square.
4. Large electrode, 6 by 12 centimetres (2 $^1/_2$ by 5 inches).
5. Very large electrode, 8 by 16 centimetres (about 1 $^1/_4$ by 6 $^1/_2$ inches).

The electrodes may be made of carbon (gas-coke), copper, or lead. When a dry electrode is required carbon is preferred; it also makes a useful form for intra-uterine applications. Where a large surface is to be covered sheet lead may be employed on clay, as used by Apostoli. Electrodes are often covered with leather or sponge, but the most cleanly and convenient covering is absorbent cotton, as suggested by Dr. G. Betton Massey, a fresh piece being applied over the electrode for each *séance*. The cotton is moistened with warm water, or with medicated solutions if desired for cataphoric purposes. Various forms of electrodes have been devised for laryngeal, intra-uterine, and other special purposes, which fill up the pages of the manufacturers' catalogues, and need not be detailed here. An exceedingly compact and complete electro-therapeutic cabinet, having galvanic, faradic, and static apparatus, with all the needed accessories, in a space of thirty-four by twenty-four and sixty inches high, has been devised by Dr. Wellington Adams, of St. Louis, Mo. It is not only an ornament to a physician's office, but he claims that it is really the most useful cabinet that has yet been produced.[1]

Physiological Effects.—The utility of electricity in medicine depends upon its power of producing physiological effects and stimulating certain functions. It is known that all muscular movements are attended by the liberation of electric currents, and, in fact, a form of battery may be made entirely of muscles, as in Galvani's celebrated experiment. On the contrary, currents of electricity, made to traverse a muscle in its normal state, will produce contractions. In the same manner, if an electric current be applied to a motor nerve, by introducing part of its trunk in the circuit, the muscles to which it is distributed will contract; sensations of pain or numbness will be caused by stimulating a sensory nerve; a peculiar taste in the mouth is caused by passing electricity through the gustatory nerves; sensations of flashes of light are caused by electrically exciting the optic nerve, etc. So that properly adjusted currents of electricity cause responses in accordance with the physiological function of the organ to which they are applied. Very little is known with regard to the electrical conditions of the deeper tissues of the interior of the body during the period of the passage of a current of electricity between the positive electrode (or anode) and the negative (or cathode), when they are applied to the surface of the body. If the electrodes

[1] See "Electricity: its Application in Medicine," by Wellington Adams, M.D., vol. ii, p. 33. George S. Davis, publisher, Detroit, Mich., 1890.

are dry, the galvanic current penetrates with difficulty, since the dry skin offers a very high resistance and is a poor conductor of electricity. If the electrodes are moistened with salt water, a small portion of the current passes directly through, from one to the other, in a straight line, but the major portion is deflected by various routes of less resistance, a considerable quantity probably following the layer of fascia and blood-vessels under the skin.

When a nerve-trunk is included in the path of the current, the part of the nerve near the anode is in a condition of decreased irritability and that near the negative of increased irritability. In the normal condition the greatest effect, therefore, is observed under the cathode, or negative pole. By numerous experiments it has been found that the contraction occurs with the weakest current, with cathodal closing; the anodal closing contraction requiring twice the strength of current; the anodal opening contraction about the same; while the cathodal opening contraction requires four times as much. This may be expressed in symbols as follows:—

Normal nerve-muscular reaction = Ca. Cl. C. > An. Cl. C. > An. O. C. > Ca. O. C. The changes in the electrical irritability of nerve and muscle are classed by Liebig and Rohé under three heads:—

1. Quantitative, or an increase, diminution, or total disappearance of electrical irritability to one or both currents.

2. Qualitative, consisting in a modification in kind of the normal reactions of nerve and muscle to electric currents. This is the so-called "reaction of degeneration."

3. Mixed or combinations of quantitative and qualitative variations of irritability. This class may also be included under the consideration of "reaction of degeneration."

The reaction of degeneration of Erb indicates a departure from the normal conducting power of the nerve and muscle, and this is usually the result of degeneration of the nerve, but it may be secondary to some lesion of the spinal cord at the point of origin of the roots of the nerve. The phenomena of reaction of degeneration are:—

Disappearance or diminution of nervous irritability to both galvanic and faradic currents.

Disappearance of faradic and increase of galvanic irritability of the muscle, generally associated with increased mechanical irritability.

Tardy, delayed contraction of the stimulated muscle, instead of the quick, lightning-like contraction of the normal muscle.

Appearance of certain decided changes of the normal formula, as just given, to An. Cl. C. > Ca. Cl. C. > An. O. C. > Ca. O. C., or some modification of this. But the typical change is the tardiness of muscle-contraction, which indicates degenerative changes of the muscle or nerve, following peripheral paralysis.

Monopolar and Dipolar Electric Baths. — The dipolar electric bath is essentially different from the franklinic electric bath (general franklinization), in which the patient is placed upon an insulated chair or stool and connected with one (negative or positive) pole of a static or friction apparatus. The results of some recent experiments are reported by W. S. Hedley, M.D., in the *British Medical Journal* (February 20, 1892, page 381), in which the effects of the bath are carefully studied. For the dipolar bath the following apparatus is required: An oak bath-tub six feet long, two feet six inches wide at widest part, the waste-pipe being insulated from earth by a short length

of rubber hose inserted near the bath; a battery of seventy-four Leclanché cells, or other battery having an electromotive force of seventy-five volts; the electrodes, thirty by twenty square centimetres, rest at each end of the bath; the water is unmedicated, about twelve and one-half inches in depth, and the temperature 98° F. The resistance of the water before the entrance of the patient measures 165 ohms, but increases rapidly as the water cools (thus, at 92° F. it is 194 ohms; 87° F., it is 264 ohms; and at 70° F., 440 ohms). A strap is stretched across one end as a head-rest, and the subject lies immersed in the water except his head, the shoulders being eight inches from the positive electrode and feet three inches from the negative. It was found by measurement that a small portion of the electric current (or lines of force) pursued the most direct course through the patient's body; upon measurement, however, it was found that the strength of the current which thus passed through the tissues was less than one milliampère; the waste of current in administering a dipolar electric bath is, therefore, much in excess of what is generally supposed. In proper hands this method of administration is an available method of general galvanization; if painful at all it is at most only pleasantly painful, and, on account of its wide distribution and even application, it is a good method for appropriate cases. The question of density becomes a complicated one in this form of bath. Here it is evident that not only the size of the electrode is to be considered, but the amount of diffusion the current undergoes in passing through the water from the electrode to the body. This depends partly upon the size of the electrode, partly on the distance, and partly on the conductivity or the specific resistance of the water. In other words, says Dr. Hedley, "we have not only to consider the size and position of the electrodes electrizing the water, but we have to look upon the whole extent of water in contact with the body as a huge electrode, carrying a widely-diffused current with a density, of course, diminished in proportion to its diffusion."

Various other forms of electric bath are in use; for instance, in what is termed the needle-bath, where the patient is surrounded by coils of pipe containing minute perforations through which water flows with force against the surface of the skin, he may be placed upon an insulated mat connected with one pole of the galvanic or faradic battery, while the other is connected with the water-pipes; in this way the current is carried by the water acting as an electrode. Where one electrode is held by the patient, applied directly to different parts of the body, the other being immersed in the bath, we have what is called the monopolar bath. The monopolar bath is not as well adapted to the treatment of disease as the dipolar, according to Stein, because of the great difference of current-density between the immersed surface and that part to which the other electrode is applied. Eulenberg considers it quite unsuited for scientific work. In the dipolar bath the current-density does not fluctuate, and polarization is at the minimum. Bartholow thus sums up the effects of the dipolar bath: In faradic baths of ten minutes' duration the electrical sensibility is increased, while a distinct diminution of motor excitability takes place. The cutaneous sensibility to faradic stimulation is for a brief time increased, but afterward considerably lessened, while to the galvanic the diminution of cutaneous sensibility occurs at once, and is maintained throughout. At first, both in faradic and galvanic baths of moderate strength, the frequency of the pulse is lessened, after a time to return to the normal. With a powerful and long-continued current-action the frequency

of the pulse increases during the bath, the tension of the vessel is elevated, and sometimes there is irregularity in the action of the heart. As respects the respiration in dipolar baths, galvanic and faradic, the number of the respirations is increased and in volume deepened, while in monopolar this effect is much less pronounced. The temperature is little affected in dipolar baths, but is lowered in monopolar. As respects the excretion of urea, the effect of the dipolar bath, galvanic and faradic, is much greater than the monopolar. All forms of electric baths stimulate the appetite, increase the digestive power, promote intestinal peristalsis, and affect agreeably the mental state; sleep is also promoted, and various functional nervous affections improved.

A form of electric bath can be given with static electricity. The patient is placed upon an insulated platform, which is connected with one pole of the machine by means of a metallic chain. The other pole is grounded. In this manner, the surface of the patient is covered with a layer of electricity, practically bathed in it. Sparks can be drawn from any part of the body if desired, by a discharging electrode.

Electricity in Medicine.—Electricity, as a therapeutic expedient, belongs to a division which is quite distinct from the ordinary classes of remedies. The various well-known forms of energy,—heat, light, motion, and electricity,—when considered as therapeutic agents, may be grouped together, for convenience, as "imponderables," or simply as "forces." The distinction is very marked between material substances, like drugs, which temporarily become a part of the human body, and during this time affect certain functions and produce disturbances of nutrition, which may or may not be ultimately beneficial, and **forces,** which directly act upon tissues and cells, exciting normal irritability of muscles and nerves, and, when properly and successfully used, aiding the functions of organs and strengthening vital powers. Electricity cannot, therefore, be considered as a department of the Materia Medica; it must be studied as a science by itself; but its application is an art which must be learned mainly by the bedside and from experience.

Essential Identity of all Forms of Electricity.—It is of the highest importance to bear in mind that electricity from any source is the same force; it only differs in degrees of pressure (tension, electromotive force), volume, and constancy. Returning for a moment to the analogy of water passing through pipes, we may have variations in **pressure** (differences of potential), or the force which enables the stream to overcome obstacles, as well as in **volume,** the latter depending principally upon the abundance of supply, the size of the pipe, and the material out of which it was constructed. Under precisely the same conditions of current-strength, or pressure, and resistance, all the so-called different varieties of electricity will produce exactly the same effects. The current from the induction-coil, which is intermittent and reversing (to-and-fro current), as has already been stated, can be commutated or made to flow in one direction, and the interruptions may be so rapid as to make the current practically continuous; it then becomes capable of producing the same effects—chemical and physiological—as are produced by the cell-current. Static electricity, properly directed and controlled, also will magnetize iron, heat a wire, or cause electrolysis. The current from a magneto-electrical machine will cause contraction of muscular fibres, produce heat and light, or electrolysis, when the same relations of pressure and volume and resistance are observed as with the chemical or galvanic current.

Different Effects Depending upon Various Modes of Application.—

Electric currents are applied through a greater or less extent of the body, according to the relative position upon the surface of the electrodes between which the force is technically considered as flowing. The effects vary according to conditions; they are classed as irritative (or excitant), electrolytic, thermic, cataphoric, and catalytic. The latter word is rather uncertain in its signification; but it is a convenient term, under which may be included the actual, but not easily demonstrable, dynamic molecular action of the current, which has been already referred to in the preceding pages and which possesses a powerful influence in correcting perverted physiological processes and in restoring parts to a normal state. In ordinary medical applications of electricity,—as, for instance, in treating paralysis of certain muscles,—this dynamic or catalytic effect usually predominates over the chemical and electrolytic actions, the latter requiring, for their production, much more powerful currents than are ordinarily employed by physicians. The **effects** of the electric current are, therefore, dependent upon the manner and method of its application. For instance, if we desire to obtain the electrolytic and cataphoric effects of electricity we employ a galvanic current of low potential, as in treating urethral or other strictures by the method of Dr. Newman, of New York.[1] Here, moist mucous membrane being in contact with the electrode (negative), the energy of the current meets comparatively little resistance and becomes concentrated upon a very small area, where it produces decided electrolytic and chemical effects. On the other hand, in ordinary medical applications, where the percutaneous method is followed, the dry, horny layer of the skin offers great resistance to the passage of the current; hence the skin must be moistened, because moist tissues carry the current better than dry ones.[2] When the current is diffused over a large surface by using large electrodes, it has its density greatly reduced, and the local effects are consequently less marked. Small electrodes, on the contrary, concentrate the effects. For the production of chemical changes, a degree of intensity of the current is required which is highly dangerous to the integrity of tissues, especially of the nerve-structures; therefore measures are adopted for limiting the effects to the immediate neighborhood of the electrode. In the Apostoli method one very large, external, abdominal electrode is employed, which diffuses the current at one pole, whereas it is concentrated around the other pole by the use of a comparatively small intra-uterine electrode. Since, even in the Apostoli method, where heavy currents are used, no **chemical** changes in the blood or intervening tissues, except in the vicinity of the electrodes, have been noticed, it follows that chemical changes are not to be expected from the usual manner of applying this valuable therapeutic agent by currents used for medical purposes. Molecular, or **physiological**, change, however, does take place, as is shown by slight increase of temperature and improved nutrition and power in parts under treatment. This is explained by the hypothesis that the ultimate forms of matter—the atom and the molecule—represent force in perpetual action, and this motion takes place according to certain fixed laws. This is equally true of the molecules composing the human body, where the motion is also directed by physiolog-

[1] See "Clinical Lecture" reported for the *Medical Bulletin*.

[2] The average working resistance of the human body and skin is about 2000 ohms, when the electrodes are properly moistened with hot water. Salt or soda may be added to the water to reduce the skin resistance, but plain water is best, as it corrodes the electrodes less and there is no electrolysis.

ical law. Now, the electric current undoubtedly influences molecular motion, and produces polarizing effects which, within limits, are strictly physiological; for this effect we have no better term at present than to speak of them as the results of the dynamic molecular influence of the current, or "electrical catalysis." The passage of a current of electricity, of either high or low tension, may be supposed to produce a tendency to polarization of molecules, all the electropositive atoms, as far as possible, arranging themselves in series with the electronegative bodies, so as to form a sort of chain of molecules of alternating electrical affinity, extending between the poles, when a portion of the human body is in circuit. As previously insisted upon, no actual flow of anything occurs, but successive waves of energy, when the circuit is closed, follow one another along the conductor, and from the positive electrode to the negative, through the tissues. These dynamic impulses, if sufficiently intense, or, in other words, if the current be strong enough, are capable of rupturing the bond between the molecules of the tissues and causing chemical change **(electrolysis)** and devitalization. In the latter case a blister and an eschar or slough **(electrocausis)** may be formed in the immediate vicinity of the electrodes and a burn of more or less depth result. Electricity of high pressure may also act upon the nerve-centres directly and cause death, as by a lightning-stroke, without producing lesions upon the surface of the body. Much lower degrees of electrical energy are employed in medicine, which, however, can be maintained within safe limits, and which produce only physiological and therapeutical effects.

Physiological Effects of Currents of Electricity.—A current of ordinary strength from a galvanic battery, passing along a motor nerve and muscle, causes contraction of the muscle at the time of making and breaking the circuit; but during the time the current is passing uninterruptedly no motion occurs. The nerve, at this time, is in a peculiar state or condition known as **electrotonus.** According to Pflüger, the portion of the nerve in contact with the anode (positive) loses its excitability and is in a condition termed **anelectrotonic**; the portion in contact with the cathode (or negative pole) has its excitability temporarily increased, and is said to be **catelectrotonic.** The anelectrotonus and catelectrotonus exist for a short distance from the point of contact of the poles, and are increased, with the augmentation of the current, up to a certain point, when they disappear. Bartholow accounts for this condition on the hypothesis that the chemical constituents of the nerve-trunk obey the laws of electrolysis, by which alkalies and hydrogen will appear at the negative pole and acids and oxygen at the positive, the effect upon the nerve being, to a certain degree, chemical. Where rapid reversals are made the muscles to which the nerve is distributed will be thrown into tetanic contraction (tetanus), and a similar condition occurs in certain morbid states from the application of faradic currents of moderate strength. This is especially likely to occur with the automatic, rapid interrupter, or rheotome, and this makes it necessary to have, for examination of such cases, a mechanism capable of making slow interruption of the battery current in the primary coil, thus giving the muscle time to recover itself between the shocks. The faradic current is more irritating and stimulating than the galvanic; but when the interruptions are very rapid (from one hundred to two hundred per second) the faradic secondary current becomes sedative; and in many cases the anode relieves pain more quickly than the cathode. The very rapidly interrupted faradic current exercises an anæsthetic effect

upon the peripheral nerve-endings, as demonstrated by the late Dr. Hutchinson, of Providence, R. I. The influence of electrical stimulation upon the nutrition of muscle has been experimentally studied by Debedat. The results demonstrated a gain of 40 per cent. in the weight of muscles stimulated by means of an induction-coil current so arranged by alternating shocks and intervals as to approach the condition of a muscle during the performance of rhythmical gymnastic movements. A galvanic current with alternate periods of stimulation and repose caused a gain of 18 per cent. in weight. Prolonged tetanization of muscle without intervals of repose by the induction coil occasioned a loss of weight. The gain in weight was due to a true increase of muscular tissue, while the loss depended upon destruction of muscular fibres. From experiments upon his own person Truchot observed that the effect of static electricity is to increase tissue-metabolism and to influence it unfavorably, but concludes that in patients who suffer from imperfect metabolism, especially neurasthenics, the augmented change is beneficial. The brush discharge from a static machine may be utilized for carrying various ions more deeply into the tissues, by the process of foresis.

Methods of Electrodiagnosis in Various Nervous Affections.—In studying the effects of brain-lesions and nerve disorders proper apparatus is essential to determine differences in reaction and other evidences of departure from the normal standard. For electrodiagnosis we require each of the above-mentioned forms of current. The faradic coil should be constructed upon the du Bois-Reymond pattern, in which the primary coil is of good size, and there should be at least two secondary coils,—one of fine wire and the other less fine,—and a scale in millimetres should be so placed as to indicate the position of the secondary coil, as related to the primary. The current is supplied usually by a single acid cell, of one and one-half or two volts, or two cells may be used of the Leclanché pattern. The external resistance being small, there is no advantage in having a larger number of cells. In all faradic machines, when in use, the cell is on a short circuit; hence the dry cell, having a tendency to rapidly polarize, soon runs down, and the battery will not again work until the cell has time to recover. The dry cell, however, is very convenient, in small, faradic batteries, for medical use, where the instrument will only be in operation for fifteen or twenty minutes at a time. To return to the large coil for diagnostic purposes, we find an advantage, as previously shown, in having the apparatus supplied with a slow, as well as a rapid, interrupter; and, for exact work, a clock-work rheotome is an advantage. With such an apparatus, muscular contractions may be obtained in some cases, in which no response will follow when the very rapid interruptions are made; or the latter may simply throw the muscle into tetanus, whereas the slow interruptions permit the muscle to recover itself between the successive contractions.

As previously explained, in the induced current from the primary coil the impulses follow each other in proportion to the rapidity of the interruptions; but they are all in one direction: that is to say, that they consist only of the currents set up by breaking the circuit, since those made by making the circuit **are short-circuited through the cell.** Therefore there is a decided difference between the poles of the primary coil, and they may be marked anode and cathode, stronger contractions being obtained with the same strength of current when the cathode is placed over the muscle at the motor point, or on the nerve.

With the secondary coil, which furnishes the to-and-fro current, it is usually stated that there is no difference between the poles and no polarity. This is not strictly true, since the currents made upon breaking the circuit are more powerful than those set up when the circuit is closed; consequently, the current in one direction will be stronger than the other and polar differences will be noted. Moreover, where the secondary coil is very long and the wire very fine, the resistance may be so great that the weaker current will not be able to pass through the additional resistance of the human tissues, and consequently we may get effects due solely to the stronger current, and the electrodes will then show anodal and cathodal differences, just as with the primary coil. The same result may be obtained from the secondary coil by the use of a commutator, as in the Ruhmkorff coil, by which both currents are made to flow in the same direction. Therefore, practical electricians who claim that there is a difference between the polarity of the electrodes from the secondary coil are quite correct, and those who maintain that there is no difference are in error.

The size of the electrodes is of importance. The indifferent electrode should be rather large, but the active electrode should be small. Erb prefers one of ten square centimetres; Stintzing uses electrodes of less than one-third of this size,—from one-third to one square inch of surface. The electrodes are provided with handles of non-conducting material and of convenient shape; they have their metallic extremities covered with leather, or, what is better, absorbent cotton, thoroughly wet with a saline solution, so as to favor the passage of the current through the skin. In order to obtain results for comparison, we not only note the number of millimetres of coil-distance, but we also use the same electrodes, moistened to the same extent and applied to the same spots with equal pressure.

For general diagnosis, the patient, with as little clothing on as is convenient, is made to sit upon a stool, and a large flat electrode (positive, or anode), covered with a wet napkin or absorbent cotton, is applied to the sacrum, or the patient may be allowed to sit upon it. If this is inexpedient, the feet may be placed in a basin containing warm water, in which the electrode is placed, connected with the secondary or primary coil of a faradic apparatus. The operator then applies the smaller (cathodal) electrode to the spine, commencing with a moderate current, and slowly carrying the electrode down the patient's back, upon each side of the vertebræ, noticing any effects which may occur, especially if tender spots are discovered. Anæsthesia or hyperæsthesia may be found, and, if so, the coil-distance in each case should be recorded. Pain is not necessarily an indication of inflammation, nor of congestion, but these are common causes. When the electrode is passed over bony prominences pain may be felt; even the ribs are sometimes painful under the application, perhaps due to the effect of the current upon the periosteum or intercostal nerves. For testing cutaneous sensibility the wire brush is useful, or an electrode consisting of a bundle of fine, insulated copper wires, contained in a hard-rubber case. In this instance, one electrode is to be placed between the shoulders and the active electrode is placed alternately upon similar points on opposite sides of the body, when any change or difference may be noted. Paræsthesia, or diminution of sensibility, is a common symptom in many lesions of the brain, spinal cord, and peripheral nerves; but in the early stage of neuritis there is hyperæsthesia, which also may occur in hysteria and some reflex neuroses.

In using the galvanic battery for electrodiagnosis we should have a sufficient number of cells (forty to eighty) to supply the proper potential for all required purposes, and the cells should not be too small for the work. The cells should be connected in series, and not in parallel. They may be connected with a pole-board and current-selector, or the current may pass through a controller, or resistance-coils, and a milliampèremeter, by which the strength of the current may be accurately measured. Where the potential is high, as in the Edison current for electric lighting, it has been claimed that, even though the current may be cut down by introducing resistance, the effects of the current are not identical with those from a battery supplying just sufficient potential for the work. The milliampèremeter may mark the same strength of current, but patients complain of more pain, and this is especially so in electrolysis for removal of hair, small nævi, etc. For such work, the galvanic cells are to be preferred, as they are more directly under the control of the operator. De Watteville's method is to place the electrodes in position and commence with ten cells, then adding cell by cell, as needed, to get the reaction desired.

Attention has been already called to the physiological nerve and muscle reactions under galvanism and the reaction of degeneration. The following will show the method of comparing the electrical reactions of the muscles of the arms, one of which is supposed to be paralyzed. Having bared both arms and the chest of the patient, place a large, well-wetted sponge, or other electrode, upon the sternum, connected with the positive pole, and apply the cathode, or small negative electrode, to the motor points of the muscles of the sound arm first and note the reaction, following this by similar applications to the affected limb.

The currents should be only strong enough just to produce contractions in the healthy muscles, and the additional amount necessary to produce contraction in the paralyzed muscles, together with any alteration in the order of the normal formulæ, should be noted. The muscles should also be tested with the faradic current in a similar manner. The patient must allow the limb to be prefectly passive during the examination; if he will not do so, the muscles may be examined after the subject has been anæsthetized. If, however, anodal closing contraction comes before cathodal closing contraction, and several trials confirm the observation, then degeneration may be positively diagnosticated. The relationship of this symptom to various lesions and diseases is set forth in the accompanying table, on the next page, which is mainly that of Erb.

When a lesion is in the cord above the dorsal enlargement, as in some forms of **transverse myelitis**, all the nerve and muscle reactions will be normal for the parts below the trophic centre, except that, possibly, there may be some increase in readiness of response to electrostimulation. If the lesion involves the dorsal enlargement, of course, there would be the reactions of degeneration. If the lesion affect the **basal ganglia** of the brain or the **hemispheres**, there will be no change in the normal nerve-muscle formula unless the disease, in its progress, produces changes in the cord, thus also affecting peripheral nerves. In a **hemiplegia resulting from a clot in the corpus striatum** there will be no change in the reactions, except that in some cases the muscles respond more readily than normal to both currents. In old cases there may be a quantitative decline, due to degenerative changes, both in nerve and muscle. In **uncomplicated lateral sclerosis** the reactions

are normal. In **amyotrophic lateral sclerosis** there will be both qualitative and quantitative changes in the muscles or partial reaction of degeneration. In **anterior poliomyelitis, infantile paralysis,** and in **lead palsy** the reaction of degeneration will be present. It will also be found in **peripheral palsies** of traumatic, rheumatic, neuritic, or diphtheritic origin. It is absent in all **cerebral, hysterical, myelitic,** and **purely myopathic paralyses.**

In cases where the reaction of degeneration is limited to a definite, peripheral, neuro-muscular area the probabilities are in favor of the diagnosis of a peripheral lesion. When the degeneration phenomena are observed over a larger area a central (spinal) origin of the paralysis is rendered probable.

Electrical Reactions.	Prominent Symptoms.	Seat of Lesion.	Pathological Conditions and their Location.
All normal.	Paralysis. No muscular degeneration.	Path of impulse from the brain (antero-lateral columns); or the brain itself.	Lateral sclerosis (idiopathic or from cerebral disease).
Nerve: Normal. Muscle: Qualitative and quantitative alterations. (Partial R. D.)	Paralysis. Muscular degeneration.	"Trophic centre" for the muscle, and also the path of impulse from the brain (antero-lateral columns).	Amyotrophic lateral sclerosis.
Nerve: At first normal; afterward diminished. Muscle: Qualitative and quantitative alterations. (Partial R. D.)	No paralysis at first. Muscular (afterward nervous) degeneration.	"Trophic centre" extending to multipolar ganglion-cells of the anterior horn of gray matter.	Progressive muscle-atrophy (of central origin). Bulbar paralysis. Mild acute poliomyelitis.
Nerve: { Reaction of degeneration. Muscle: {	Paralysis. Atrophy of muscles and nerves. Abolition of reflex actions.	Multipolar ganglion-cells of the anterior horn of gray matter.	Anterior poliomyelitis. Infantile paralysis. Lead poisoning.
All normal.	Paralysis. No degeneration.	Motor nerve-fibres.	Light form of rheumatic, traumatic or pressure paralysis.
Nerve: Normal. Muscle: Qualitative and quantitative alterations. (Partial R. D.)	Paralysis. Muscular degeneration.	Motor nerve-fibres and path of trophic influence to muscle.	Middle form of ditto.
Nerve: { Reaction of degeneration. Muscle: {	Paralysis. Muscular and nervous degeneration.	Motor nerve-fibres, path of trophic influence to muscle, and path of same to nerve.	Severe form of ditto.
Normal, or diminution to maximum excitation.	Pseudo-paresis. Simple atrophy.	Muscular fibre.	Muscular wasting in phthisis, etc., and in diseases of the joints. Idiopathic myositis.

In **light forms** of rheumatic, traumatic, or pressure paralyses the reactions will remain normal, but in **severer forms** the reactions of degeneration develop themselves. In **muscular wasting,** or **simple atrophy,** as in phthisis, in diseases of the joints, and in idiopathic myositis, the reactions are normal or may be quantitatively reduced. When the reaction of degeneration, either complete or partial, occurs, we conclude that an alteration (degenerative atrophy) has taken place, either in the trophic centres or motor fibres going to the affected muscle, although Gessler claims that no such reaction is given unless the muscular structure has also undergone degeneration.

It should be borne in mind that it is the density of the current in the

nerve which determines the amount of excitement, and not merely the volume of the current as registered by the milliampèremeter, and that this **density in the nerve** is controlled by the **size** of the active electrode and the **location** of the two **electrodes** (Adams), as well as the current-intensity. Attention is no longer given to the **direction** of the current, so that no advantage is gained by placing the two electrodes on the skin along the course of the nerve. The indifferent electrode may be above or below the point of application of the **testing,** or **active,** electrode, as it is the action of the pole upon the part that is sought, and not the direction of the current.

Clinical Electro-therapeutics.—The clinical applications of electricity are partly deduced from the scientific data just given, and partly derived from experience. Although the essential identity of electricity from all sources is insisted upon, it is to be noticed that, under different conditions, and especially when supplied from different sources, the effects depend largely upon the conditions and methods of application. In practice, therefore, it is convenient to speak of electricity from the galvanic battery, the faradic coil, or the static apparatus as if they were actually different kinds of electric current. Indeed, it has been found that no one form is applicable to every purpose, and the physician, therefore, requires several forms of apparatus, and it needs some knowledge of the subject and some experience in order to determine which form shall be used. According to Rockwell, in nearly all cases where electricity is called for, each one of the forms—faradism, franklinism, or galvanism—might, at one time or another, possess positive value over the others. This authority gives the following differential indications for the use of dynamic and franklinic, or static, electricity: "Hemiplegia, accompanied by exalted muscular contractility, calls for a mild and rapidly-interrupted **faradic current,** if for any form of electricity whatever. Indeed, this current is usually preferable, if the muscular contractions were only somewhat less readily called out than in the normal state. The **galvanic current** is indicated when there is very great diminution of electro-muscular contractility. In most cases of paraplegia, either complete or proximate, loss of farado-muscular contractility exists,—at least, for a short time, —and the galvanic current alone is applicable. The faradic current might be useful in attempting to improve impaired nutrition of the paralyzed members. The constant (galvanic) current is alone applicable for directly affecting the central nervous system. In the great majority of cases of neuralgia, where firm pressure over the affected nerves aggravates the pain, the galvanic current is indicated; if pain is not increased by pressure the faradic current should be used. Hysterical hyperæsthesia calls for the faradic current. While it is impossible, in many diseases, to say that a particular current is indicated to the exclusion of others, it is possible to name a variety of conditions where, as a rule, one method of treatment with one form of current is superior to others. The faradic current is indicated, for its tonic effects, in cases known as general debility." The static current has a special range of usefulness, especially for office practice.

Some few distinct organic or functional diseases in every phase of their manifestation, according to Rockwell, demand a single form of electricity. For instance, asthenopia, accompanied by hyperæsthesia of the retina and ciliary nerves, seems to require the faradic current. It is also useful in the paralysis following diphtheria, in which galvanism is of little service. Galvanism is particularly useful in special irritation or neuralgia, and in certain

neuralgic sequelæ of cerebro-spinal meningitis; also, in treatment of exophthalmic goitre and in restoration of the sense of taste or smell. It is superior to faradism in the treatment of skin affections. The form of electricity required in chorea varies according to the general condition of the patient: central galvanization in the well nourished, and general faradization in those whose general nutrition is impaired. The same may be said of amenorrhœa; but in dysmenorrhœa the galvanic current is more frequently indicated.

"Franklinic electricity is less efficacious as a constitutional tonic than general faradization, but is a valuable supplement to the latter. The pain of myalgia (muscular rheumatism) is relieved by franklinism sooner and more effectually than by other methods, and it acts best when applied by a roller. Franklinism is superior to either galvanism or faradism for relieving pain of a chronic character, confined to no special nerve-trunk or distribution, with no tenderness on pressure over the nerve. It is also most efficacious in treating the enlarged joints of subacute and chronic rheumatism; and in facilitating absorption in synovitis it is best employed in the form of sparks. It is often superior to other forms in old contractions and in cutaneous anæsthesia. It has, however, a far more restricted field than galvanism, and is less convenient than either of the allied forms of electricity."[1]

Central Galvanization: Cautions with Regard to its Employment.—The method of **central galvanization,** as practiced by Beard and Rockwell, when supplemented by skillful manipulation, has produced very striking results, but it cannot be considered entirely safe in unskilled hands, and probably should not be attempted by the average operator. "The object of central galvanization," according to the authority just quoted, "is to bring the whole central nervous system,—the brain, sympathetic, and spinal cord,—as well as the pneumogastric and depressor nerves, under the influence of the galvanic current. One pole (usually the negative) is placed at the epigastrium, while the other is passed over the forehead and top of the head, along the inner borders of the sterno-cleido-mastoid muscles, from the mastoid fossæ to the sternum, at the nape of the neck, and down the entire length of the spine." The application to the head is made by passing the pole (positive), from one temple to the other, over the forehead, using from two to six cells (about 2 to 5 milliampères), or increased until a sour or metallic taste in the mouth is experienced by the patient. The electrode is allowed to rest for a minute or two upon the cranial centre or vertex, because a current passing from this point to the epigastrium traverses the facial-nerve roots and others in the medulla, and also the sympathetic. A labile application or sudden interruption of the current may cause dizziness or mental confusion. During from one to five minutes, the electrode is next passed on both sides, down the neck, as above described, thus affecting the pneumogastric, as well as the ganglia of the sympathetic. A weak current only is permissible here. Proceeding next to the spine, an especial application is made over the cilio-spinal centre, between the first and seventh cervical vertebræ. Although recent observations make it very doubtful if the current actually reaches the spinal cord, there is no question about the effects upon the spinal nerves, and so the cord may be affected indirectly; and the same remark applies to the great sympathetic ganglia. The positive pole is carried the whole length of the spine, the application lasting from three to six minutes. The whole

[1] *Philadelphia Medical Times*, vol. xiii, p. 345.

length of the sitting required for central galvanization should not exceed fifteen minutes. The disrobing required is simply, in a male patient, the removal of the coat and waist-coat and loosening of the clothing, so that access can be had to the epigastrium and the spine; and, in female patients, it is necessary to remove the corsets and to loosen the clothing at the neck and waist. The electrodes employed by Drs. Beard and Rockwell were a sponge- or flannel- covered, flat electrode (negative), having an insulated handle, by which it is held to the epigastrium by the patient himself. For the positive pole a flannel-covered electrode is used, having the disk parallel with the handle, so that it can be passed along the spine under the clothing. The battery should be a constant one, and furnished with a rheostat.

Objections to Galvanization of the Sympathetic in the Neck.—The best authorities speak of galvanization of the cervical sympathetic as a dangerous procedure, on account of the proximity of the pneumogastric nerve. Brown-Séquard remarked that he once tried to galvanize the cervical sympathetic of a friend in order to relieve him of a violent headache. "The effect was all we could desire against the headache, but the galvanic current (acting at the same time on the sympathetic and vagus, the simultaneous action of these two nerves cannot be avoided) produced such dangerous syncope that I would never again attempt to apply galvanism to the cervical sympathetic of man."

The galvanic current differs clinically from the faradic current in having much greater quantity with less tension or difference of potential, and hence produces greater dynamic and physiological effect than the latter, which, owing to very high tension, is apt to cause pain and excite muscular spasm, even with weak currents. It may be continuous or interrupted, and, as it is definite in its direction, it is capable of being reversed. Owing to its large volume, or quantity, it penetrates the tissues more deeply.

The Medico-legal Value of Electricity in Diagnosis.—Dr. W. B. Pritchard reports[1] a case of traumatic neuritis in which electricity proved of much value in aiding the diagnosis. "A man, aged 49, received an injury to his shoulder under circumstances which would have entitled him to some compensation if any permanent damage had been done. When the swelling had gone down he complained of great pain in and around the shoulder, and of inability to raise the arm from the side. It could not at the time be determined whether this was due only to the pain, or whether there was loss of muscular power. There were tenderness and pain in the areas supplied by the supra-acromial branch of the cervical plexus and circumflex nerves, and some hyperæsthesia of this region. In the course of the next few months the pain and weakness remained much about the same, and it was then found that the circumflex nerve gave the reaction of degeneration. This set all doubt as to the existence of a traumatic neuritis at rest, and the patient succeeded in obtaining compensation without going into court."

Special Applications of Electricity in Clinical Medicine.—Disorders of the locomotive apparatus were probably the first to suggest the employment of electricity in medicine, owing to the fact of the contraction of the healthy muscular fibres when a current is made to traverse them, especially if the position of the electrode correspond with the entrance of the nerve into the muscle or the nerve-trunk itself. Paralysis, therefore, was the first condition

[1] *New York Medical Journal*, Nov., 1890.

to receive electrical treatment, and still is regarded as being especially amenable to the current. Pathological research and clinical observation have finally revealed the varied causes of paralysis, and clearly show the reason why a form of treatment so efficient in some cases is useless, or even injurious, in others. Paralysis of a muscle, or group of muscles, may be due to purely local causes; it may be due to a lesion of the nerve-trunk, or in its fibres of insertion or origin; it may also be due to a disorder of the centre in the brain or cord corresponding to the muscles affected, or to reflex irritation. Occasionally we see it caused by some remote or reflex cause which influences the nerve-centres, as in paralysis following intestinal inflammation, or in the form known as hysterical paralysis. When a morbid condition arises from such a diverse cause as in the example just cited, it is very evident that the scientific treatment, which includes removal of the cause where it is possible so to do, would depend upon the diagnosis. The first principle of successful application of electricity, therefore, as already stated, is correct diagnosis, and a clear appreciation of the objects sought to be obtained by the current to be employed, and in some cases a combination of different forms of current will be necessary in order to attain the desired result. If to good diagnostic powers we add familiarity with the effects of electricity and skill in their applications to produce such effects in the living human body, we are in a position to employ this invaluable therapeutic agent with every prospect of success. In the following pages a review of some of the recent and more useful applications of electricity is presented, but for a complete exposition of electro-therapeutics we must refer to the systematic treatises of Beard and Rockwell, de Watteville, Liebig and Rohé, and the numerous monographs by Apostoli, Massey, Adams, Peterson, and others.

Electricity for the Relief of Pain.—The late Dr. Hutchinson[1] employed the faradic current by preference in **muscular rheumatism**, observing strictly the following precautions: A coil must be used which gives a fine, steady current—*i.e.*, one without jumps or sudden interruptions—and of adjustable force. Only so much ought to be used as produces a distinct vibratory sensation without sharp pain. Before applying the electrode see that the skin is thoroughly dried and well powdered with a good conductor, and for this purpose starch is not so good as a mineral substance like powdered clay. The active electrode should be of polished metal,—a ball or rounded tube,—kept dry and warm; the passive may be a small sponge, held in the hand or at any indifferent point. Beginning with a force scarcely felt, slowly increase, keeping the active pole in constant motion over the painful muscles, observing carefully to avoid contracting a single fibre. If muscle contraction be produced, no good results. All the force must be expended upon the skin; in other words, upon terminal nerve-filaments, which are alone the seat of pain in this annoying disease. Every inch of skin covering painful parts should be carefully gone over with the current, exercising a steady, slight pressure, for about a half-hour, and applications repeated twice daily until the case is well. It is unusual, he states, for a violent attack to persist more than two days with this treatment. De Watteville also recommends cutaneous faradization, and states that galvano-faradization may, with advantage, be sometimes substituted for it. He also says that the galvanic current may be applied: the current—moderate to strong

[1] *New England Medical Monthly*, Sept., 1891, p. 622.

—is passed for a few minutes, and the sitting concluded with a series of interruptions or voltaic alternatives, so as to excite the muscular tissue to contraction. We have obtained excellent results in pain confined to muscles —**myalgia, lumbago, stiff neck**—by a resort to static electricity, which affords marked relief to the pain and does not require removal of the clothing.

The treatment of **articular rheumatism** by electricity is exceptional, and yet Dr. W. F. Robinson, of Albany, N. Y., reports excellent results from it.[1] Therapeutically, he divided cases of rheumatism into two classes: those in which only one or two joints are affected, which he always treats by means of galvanism; and, secondly, those in which the rheumatic poison is more extended in its action, involving joints, muscles, fascia, etc., for which he employs static electricity. The electrodes, he writes, should be large and carefully made. If covered with sponge, this should be soft and free from gritty particles. In order to increase the conductivity of the skin, the sponges should be saturated with a hot solution of bicarbonate of soda. The caustic action and the electrolytic action of the electric current are to be avoided in the treatment of rheumatism. The action of vital stimulation is to be sought; to obtain it the procedures of interruption and voltaic alternation must be adopted. Voltaic alternation is a still stronger stimulation than interruption, but it must be used with caution, for with strong currents the pain and irritation are very great. Joint rheumatism, pure and simple, is almost powerless to withstand the direct application of the galvanic current. When the disease is more diffused, and involves various tissues and organs in different parts of the body, static electricity is indicated. The general charge is rarely used alone, and static electricity is usually given, by means of special electrodes, in the form of sparks. The applications may be made on alternate days. The usual length of the treatment is ten minutes, for about five of which sparks are drawn, the patient during the remaining five minutes simply sitting quietly upon the platform and taking the general charge.

Dr. Robinson states that electricity has a twofold action that meets all the indications of rheumatism: a specific action against the morbid process, and a general tonic action that tends to build up the system depressed as a result of the disease. Dr. Goelet, at the same meeting, stated that the sedative effects of galvanism could best be had by currents of short duration. He prefers a clay electrode, made of the consistency of putty, and maintains it so by keeping it moist. A flat pad is made by rolling it on boards, as if it were dough; it is gotten into shape, and, after having a metallic plate placed on the back, is covered with a layer of absorbent cotton, and is then sewed up in a gauze cover. On the back is placed rubber cloth, just as in sponge-covered hand-electrodes. To avoid the discomfort of a cold application, the electrode may be kept on a warming-pan, consisting of a flat tin or zinc jug filled with hot water. Dr. M. A. Cleaves also reported cases in which marked benefit followed the use of the galvanic current in **articular inflammatory exudations.** Stabile applications, of 10 milliampères' strength, for fifteen minutes, with the anode at the sternum and the cathode applied over the affected joint, were followed by relief from pain, diminution of heat,

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[1] "Proceedings of the American Electro-therapeutic Association." First Annual Meeting, Philadelphia, 1891. *Medical News* reprint.

and increased mobility. The current was used daily for a week, and then every two or three days, until thirteen *séances* were given, when faradism was applied to the muscles around the joint, with the cathode at the sternum and the anode applied successively to the motor points of the various muscles. The ultimate result was decided and satisfactory. Ankylosis, the result of chronic inflammatory processes, even with some osseous union, according to Dr. von Raitz, of New York, yields to the constant current, with the assistance of massage and passive motion. The various forms of **neuralgia** are amenable to electrical applications—in all cases for amelioration, in most cases for cure—in proportion as they are pure neuroses, and not the result of decided structural change. Electricity, says Dujardin-Beaumetz, is one of the most active agents in the treatment of rebellious neuralgias. Galvanic currents are preferred to faradic. The negative pole is applied near the nerve-centre; the positive pole (which is the truly sedative pole) may be moved over the different painful points of the affected nerve. In **tic douloureux** the currents should be very mild,—not to exceed 3 to 4 milliampères. In sciatica much stronger currents are required (20 or more milliampères). He agrees with Apostoli in holding that the stabile applications should be continued until the pain disappears or some mitigation is observed. Duchenne preferred the use of faradism,—applying the wire brush over the affected area, and employing a very strong current with rapid interruptions. Electropuncture, as practiced by Magendie, is no longer used.

Electrical Foresis (Anaforesis and Cataforesis), by means of which medicaments are carried through the skin under the action of electric currents, is a valuable addition to our resources. As shown some years ago by Adamkiewicz, the wetting of the active electrode with chloroform favors local absorption. Cataforesis was first recognized, and experiments made with compounds whose cations were analgesic were successful. For instance, we may use cocaine solution (10 to 20 per cent.). Aconitine may be substituted, or any soluble alkaloid. Diseased conditions, at or near the surface, are easily treated locally by this means, even including painful tumors and aching teeth. If a considerable quantity of medicament is sought to be introduced, we may have the electrode in the form of a tube closed at one end with a porous partition (du Bois-Reymond's conducting tube, stopped with a plug of clay), and since, according to Munk, the current should be occasionally reversed, it is necessary to have both electrodes charged with the substance used. Dr. Arthur Harries[1] prefers cocaine cataphoresis to hypodermic injections. He employs a large negative electrode wet with a salt solution, and the positive is small, covered with flannel, and wet with a 10-per-cent. cocaine solution. A continuous current of 25 milliampères is then passed for forty minutes, the electrodes being kept moistened with the solution. Peterson[2] claims that "the anæsthesia produced by a 10- to 20-per-cent. solution of cocaine on the anode is sufficient for small operations, and affords distinct relief for from four to eleven hours in cases of severe neuralgia in superficial nerves." His method of securing accuracy of dosage, which is as follows, is ingenious: "It is necessary to use a flat, metal electrode, made preferably, but not necessarily, of platinum or tin. It may be of any convenient size and shape. A piece of filtering-paper or linen is

[1] *Lancet*, Oct. 25, 1890.
[2] *Medical Record*, Jan. 31, 1891.

cut to fit over the metal surface; this is soaked with a definite quantity of the solution to be used, and the electrode is then applied to the skin. A narrow soft-rubber rim at the edge of the electrode prevents any loss by evaporation. In order to have drugs ready for use at any time, disks of paper to fit the electrode may be charged with aqueous or alcoholic solutions and then allowed to dry, a drop or two of menstruum being added when they are to be used. The strength of current is regulated largely by the patient's feelings, but from 5 to 20 milliampères, or from 10 to 30 cells may be used for five to fifteen minutes. The stronger the current, the shorter the duration of the sitting. The indications are: 1. To produce local anæsthesia for neuralgia, superficial pains, and cutaneous operations, a 10- to 20-per-cent. cocaine solution is used. Aconitine produces a deep analgesia, but it is accompanied by severe smarting around the edges of the anæsthetized area. Three or 4 drops of a 1-per-cent. solution of helleborin cause a deeper and more lasting anæsthesia than cocaine, without producing constitutional effects. Both ouabaïn and strophanthin, in doses of 0.00026 Gm. (or gr. $^1/_{250}$) or more, are strong local anæsthetics. One or 2 drops of chloroform bring about a deep analgesia in a short time, but this is followed later by vesication. A mild solution of carbolic acid may also be employed as a local anæsthetic and analgesic. 2. For topical medication in various local lesions,—such as tumors, rheumatic, gouty, and other swellings; various skin diseases, syphilides, etc. In these cases iodine preparations, lithium, and mercuric salts may be used. 3. To induce absorption of medicines from baths. 4. For diagnostic purposes. Thus, if a pain were complained of in the region supplied by the trigeminus nerve, it should disappear under this treatment; if it did not, the lesion could be localized farther back, or it might lead to the conclusion that it was an hysterical pain."

In a communication to the American Electro-therapeutic Association, Peterson stated that special forms of electrodes are no longer considered necessary, since ordinary sponge-covered electrodes will answer for solutions where accuracy is not specially required, and metallic ones for the more careful administration. The latter are supplied with a narrow rim of rubber to prevent evaporation, and a disk of cotton cloth, tissue- or blotting- paper may be cut to fit the surface, and upon this the desired number of drops of the drug in solution can be placed. Disks of filtering-paper containing a known quantity of the remedy may be kept on hand for this purpose. Cocaine employed in this way does not cure neuralgias. All that is claimed for it is that it affords relief without producing constitutional effects, and is, therefore, superior to any narcotic given internally. Where the cause of the neuralgia is deep-seated, the improvement is much less evident than when the lesion resides in a superficial nerve, and Dr. Allen Starr calls attention to this valuable hint in diagnosis, as regards the question of surgical operation. If the pain be relieved temporarily by the treatment, the lesion is in the immediate neighborhood or peripheral to the anæsthetized area, and this would suggest the possibility of permanent cure by neurectomy or nerve-stretching. Dr. Fouveau de Courmelles, of Paris, presented a paper at this meeting of the Electro-therapeutic Association in which he stated that the pain of hepatic or renal colic may also be made to disappear by medicamental electrolysis or cataforesis.

Dr. G. Betton Massey, of Philadelphia, reports success in some cases of carcinoma uteri by the cataforic destruction of the diseased tissues. His

method consists in the interstitial dissemination of the nascent oxychloride of mercury, or of the mixed oxychlorides of zinc and mercury, throughout the growth by radiant cataphoresis. The current-strengths will vary from 350 milliampères, in small growths, to 1500 in large ones, for durations varying from fifteen minutes to half an hour. Seven cases have been reported cured, including both carcinomata and sarcomata.

In some surgical conditions, such as stricture of the urethra, rectum, or œsophagus, due to cicatricial stenosis, the application of the method as practiced by Dr. Neumann, of New York, to stricture of the urethra, will serve to illustrate the usefulness of skilful electrolysis. It should be understood that this is entirely different from cauterization such as seen in the Apostoli method. Much milder currents are employed, and the principal object in view is to cause the absorption of the inflammatory exudate, or scar-tissue, which softens under the electrolytic influence of the current; but there is no charring of tissue and no subsequent sloughing. Insulated urethral sounds are used, terminating in an exposed olive-shaped bulb, which should be a little larger than the calibre of the strictured urethra. After being made thoroughly aseptic, this is passed down to the tender spot in the urethra and the negative cord attached; the other electrode, covered with sponge or cotton of the usual shape, may then be applied to the thigh; the current is then gradually turned on until 4 or 5 milliampères are passing. The sound is then gently guided through the stricture, allowing it to make its own way until the stricture is passed; the circuit may then be opened and the electrode withdrawn. The sittings should be twice a week, and should not exceed five minutes each. After each operation the parts should be bathed with hot water containing boric or carbolic acid. Some bleeding and increased tenderness may be noticed after the first few applications, but these become less, and in from ten to twelve sittings the cure is complete. In many cases, though, no positive prediction can be made as to the time required. Electrolysis was recommended by Heryng for the removal of hard, diffused tuberculous infiltrations of the larynx and in chronic affections of the vocal cords with little or no superficial ulceration. He found it of service also in counteracting the tendency to dangerous hæmorrhage in the removal of nodules of the ventricular bands.

In **new growths, tumors,** etc., electrolysis promises to be of great service. This method has likewise proved of value in promoting cicatrization of acute and chronic ulcers. Dr. J. Inglis Parsons has reported[1] encouraging results from the treatment of rodent ulcers by electrolysis. In ordinary cases he found one application sufficient, but when the ulcers were large the operation was once or twice repeated. The procedure prevents hæmorrhage, is not followed by pain, causes no shock, and if the wound is kept aseptic no rise of temperature takes place. Two needles are employed with a current-strength of 200 to 400 milliampères. The caustic action of both poles is freely used, and the current is constantly alternated with a hand-commutator. The amount of destruction can be accurately regulated by increasing or diminishing the strength of the current.

Pulmonary tuberculosis has been treated with encouraging results by means of the introduction of germicidal agents by cataphoresis, as proposed by Francisque Crotté, in 1896. The vapor of formaldehyde has been trans-

[1] *Lancet*, Nov. 11, 1893, p. 1175.

fused through the tissues of the chest. The patient is placed in an isolated chair of the static machine and towels saturated with formaldehyde solution are applied to his chest and back (the solution varies from 1 to 10 per cent., according to tolerance). The current is then started, with effluvia or sparks or both, and is made to pass through the lungs.

In connection with the introduction of various remedies through the skin by electrical foresis, some remarkable results have been obtained by Adamkiewicz, Peterson, and others. The fact that medicines may thus be introduced into the body has been abundantly proved, and it seems evident that this new method is capable of very valuable applications. The medicament is carried directly to the diseased cell, and thus produces a more marked effect than if it were diluted by the circulating fluid. Moreover, electrolysis of fluids and solids tends to occur in the vicinity of the poles, thus liberating remedies in nascent form, which is one of special activity. Dr. Woodbury treats syphilitic new growths with lithium-iodide solution, using absorbent-cotton electrodes, and urges a similar treatment of various tumors in the same manner. The success of Dr. A. C. Garrett, who reported one hundred and fifty-seven cures out of one hundred and eighty-six cases of tumors (indurations?) of the breast, by means of direct application of the galvanic current, should encourage further experiment in this direction. "There is reason to believe," says Dr. Rohé, "that the limitations of electrical treatment of malignant tumors have not yet been reached." It was suggested by Woodbury[1] that various chemical agents might be tested, until one be found which has a special inimical influence to the cancer development, and that the prospects then would be favorable for the successful treatment of malignant tumors by the introduction of such agents by means of electrocataphoresis directly into the interior of the growth. Dr. Augustus le Plengeon, of New York, states that, as far back as 1865, he used galvanic currents not only to introduce medicaments into the human system, directly on the parts diseased, but also to extract from them extraneous matters which caused the disease—metals, mercury particularly—and in this he had been most successful. Part of the good effects ascribed to electroforesis may be really due to electrolysis.

In **goitre** the galvanic current may be used percutaneously, but better results are obtained by the use of needles with negative electrolysis. Dr. James Hendrie Lloyd[2] uses three gold-plated needles well insulated to within one-third of an inch of the point, connected by a branching cord so that all were attached to the negative pole. The needles were inserted well into the goitre, far enough to protect the skin by the insulating material. The positive pole, a large flat sponge, was applied to the nape of the neck. The greatest strength was 24 milliampères, but this could not be kept up; the average was about 15 to 18 milliampères, the *séance* being about twenty minutes. The author reports a patient as cured by fourteen applications.

In various forms of neuralgia, relief may be afforded from the action of galvanism by anodal diffusion over the painful spots. In no painful

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[1] Paper read before the Philadelphia College of Physicians, "On the Employment of the Cataphoric Action of the Galvanic Current for the Removal of Syphilitic New Growths. A Contribution to the Medical Treatment of Tumors." *Medical News*, June 21, 1890.

[2] "The Treatment of Goitre by Galvano-puncture." By James Hendrie Lloyd. *University Medical Magazine*, Dec., 1890.

affection, says Bartholow, is the application of electricity more conspicuous for good than in **sciatica.** Large sponge-electrodes, moistened with hot water, are applied, both—labile and stabile—over the course of distribution of the nerve, using currents of 20 to 40 milliampères. The applications should be made twice a day, if possible, or at least once daily. **Intercostal neuralgia** and **herpes zoster** also yield to galvanism, using small electrodes, applying one (usually the cathode) to the spine and the other to the distribution of the nerve in front; or to place the anode over the painful points where the nerves become superficial, and the cathode on the terminals.

In **migraine,** in addition to the administration of remedies directed to the stomach, we apply galvanism, in the same manner as just indicated, to the supra-orbital nerve distribution. Galvanization of the sympathetic in the neck and of the pneumogastric, as practiced by du Bois-Reymond, can only safely be practiced by an expert. Faradism, with very rapid interruptions and mild currents, may be used, in conjunction with gentle massage (the electrical hand). In nervous vomiting, and especially the vomiting of pregnancy, a descending current of voltaic electricity exerts a remarkable remedial effect, the positive pole being applied above the clavicle and the negative to the pit of the stomach. In **angina pectoris** Eulenberg reports good results from galvanism administered in the intervals between the attacks. The indifferent pole may be placed in a basin of water, or in a foot-bath.

Various forms of **visceral neuralgia** are amenable to galvanism. The applications may be entirely to the surface of the body, or one electrode may be introduced into the stomach, rectum, or vagina. Faradic electricity may also be used; mild currents and frequent interruptions for the sedative effects, and the electrical brush, with stronger currents, to the skin as a counter-irritant.

In **gall-stone colic** with impaction, good results have been obtained by passing brief currents of high intensity, the electrodes being placed in the hypochondriac regions. The electrical stimulus produces contraction of the fibres entering into the common duct, and the consequence is that the stone is discharged into the intestine.

The Static Current in Neuralgia—Morton's Method.—For pain not accompanied by evidences of acute inflammation, perhaps no form of application can equal franklinism. Indeed, Adams states that, "in all vasomotor disturbances, functional cerebro-spinal diseases, or neuroses, there is nothing, in the author's experience, which equals in value the diffused and the concentrated constant high-potential currents from electrostatic induction machines." As already explained, the diffused constant current or electrostatic bath is where the patient is placed upon an insulated platform and charged with the current. The concentrated constant current is obtained by bringing an electrode near to any desired spot upon the surface, and thus drawing a shower of sparks from this locality. In the former case the circuit is completed at all parts of the body through the air, and in the latter by means of the spray coming from or going to a pointed metallic electrode which is in connection with the ground. By an ingenious device of Dr. W. J. Morton, of New York, contained in a peculiar-shaped instrument named, in consequence, the "pistol electrode," the current is tapped in the rheophore, and the electrodes may be placed directly in contact with the patient's body, just as in the application of the faradic current. In using this method

of Morton, as practiced by Bartholow, one brass chain is fastened to the top brass knob of one condenser (the left one being the higher potential), and another brass chain is placed around the base, over the metallic coating of the other condenser, and to each chain an ordinary electrode (preferably a carbon electrode), covered with leather, is attached. The discharging rods are placed at a distance apart, which is determined by the effect to be accomplished, which consists in the faintest tingling when the rods are nearly together, or the most powerful muscular contractions when they are some distance apart. The same kind of irritation of the sensory nerves is caused by this interrupted current as that caused by the faradic; but it is softer. The most powerful muscular contractions can be produced without causing pain; and in this respect static electricity possesses distinct advantages over faradic. The interrupting handle of Morton is dispensed with in Bartholow's method; indeed, no special electrodes are required, and only as much of the current is taken as is desired.

Either electrization by sparks or by the Morton method may be employed with advantage in trifacial, intercostal, sciatic, and other neuralgias. General franklinization is especially useful in **hystero-epilepsy.** Dr. Morton reports brilliant results with static electricity in cases of neuritis, locomotor ataxia in the earlier stages, and rheumatoid arthritis, which have been apparently cured or their progress completely arrested by the use of the long percussive spark and other forms of static electricity.

Dr. S. H. Monell regards static electricity as surpassing any other agent in the management of hysterical conditions. He esteems it of superior value, also, in combating nausea, dyspepsia, constipation, and colic. In chlorosis and anæmia it improves nutrition. It is an efficient cardiac tonic in both functional and organic disease of that organ. This writer asserts that franklinism is the most powerful means at our command for relieving the pain of locomotor ataxia, and that, used in conjunction with galvanism, it may indefinitely arrest the progress of early cases. In all forms of motor paralysis it has given excellent results. Static electricity is of decided service in chorea, and in epilepsy it moderates the frequency and severity of paroxysms. In exophthalmic goitre, gout, rheumatism, and lateral curvature of the spine this form of force is of benefit. Imbert de la Touche, of Lyons, concludes that obesity of nervous origin and the fatty anæmia common in neurasthenia are beneficially influenced by electricity, and that the static electric bath is the preferable mode of application. The brush discharge from a static machine may take the place of the anode in foresis. Tuberculous glands may also be treated in this way.

Anæsthesia is very commonly functional and often a manifestation of hysteria. In such cases the anæsthetic area will, under a few applications of the faradic brush, rapidly recover its tactile sense. When the loss of sensation is due to inflammation, compression, traumatism, or other lesion, except actual loss of continuity of nerve-fibres, it will, as a rule, also be soon restored by electricity. When the galvanic current is employed the anode should be over the nerve-root and the cathode over the anæsthetic area, or the galvanic brush or faradic brush may be used. In **trigeminal anæsthesia** Liebig and Rohé indorse transverse brain galvanization; galvanization of the trunk and branches of the fifth nerve; the faradic brush to the anæsthetic surface, or to a small area of the forearm, as recommended by Vulpian. **Hemianæsthesia,** due to central or toxic causes, very frequently yields

to the application of the faradic brush according to Vulpian's method. **Tabetic** and **traumatic anæsthesia** may be relieved, but not fully restored, unless the nerve-trunks can be made to resume a normal condition. **Anosmia**, or loss of the sense of smell, if not depending upon disease of mucous membrane, may be cured by faradization. In weakness of vision, amblyopia, amaurosis, **anæmia of optic disk**, and especially in tobacco-amaurosis (scotoma) electricity is of great value, the applications being made through moist compresses applied to the closed eyes: the anode locally, and the cathode to the temple or the cheek. The strength of the current should not be greater than just enough to cause faint flashes of light, and the *séances* should last only a few minutes. Galvanism should also be directed to the cervical sympathetic and to the cilio-spinal region of the spinal cord. In anæsthesia of the auditory nerves, and in tinnitus aurium, Brenner, Erb, and others have conclusively proved the value of the polar method. The canal is filled with warm water; a special electrode may be used, or the ordinary small electrode may be dipped into the water and inserted into the ear. By the judicious use of this expedient tinnitus aurium has been stopped after it had existed for years. In some cases very marked improvement was noticed after the first application or after a few applications.

Electricity in the Treatment of Paralysis. — The favorable influence exerted by electricity over nutritive processes and cell-growth, especially in the form of galvanism, has made it the indispensable remedy in the treatment of various forms of paralysis, whether due primarily to nerve or to muscle. It is not judicious, in **hemiplegia**, to employ the electric current too early, on account of the lesion in the brain; but after the first shock of the brain-injury is over, whether an extravasation or an embolus, and the parts are accommodating themselves to the condition and repair is going on, in a week or two after the attack came on, the electric current may be used to keep up the nutrition of the muscles, employing both galvanic reversals and the faradic interrupted or labile applications. The precaution should be observed of only using a current strong enough to produce moderate contractions, and not continued very long (fifteen to twenty minutes for the entire *séance*). In various forms of **monoplegia** and paralysis of individual muscles, galvanization may show the reaction of degeneration due to local nerve- or muscle- changes; but the systematic application of galvanism, at first stabile, followed by a few current-reversals, and the faradic brush or static breeze or sparks, will cause the normal function to be restored. Hygienic remedies must not be neglected, including massage, baths, and passive exercise. In **diphtheritic paralysis**, or **paralysis following typhoid** or other **exhausting** diseases, brain and spinal galvanization, with direct applications of both faradism and galvanism, should be resorted to. Static electricity is also useful here. In **lead palsy, mercurial paralysis**, and similar toxic paralyses, the galvanic current may be applied to the affected groups of muscles, and the faradic to their opponents. **Paralysis of the laryngeal muscles** may be treated by intralaryngeal applications of galvanism or faradism, with special electrodes, as practiced by Elsberg or by von Ziemssen. Equally good results, it is claimed, may be obtained by the method of Erb, in which the anode is placed under the occiput at the root of the neck, and the cathode applied to the front of the neck along the larynx and trachea. Faradism may be applied in the same way, but weak currents only should be used.

In paralysis dependent upon chronic poliomyelitis, Hammond has re-

ported several cases which seem to show that persistent daily use of galvanism may measurably restore the function of muscles which, at the first examination, exhibited no visible reaction.

In **aphonia of hysterical origin** the faradic brush or the static spark is promptly curative. In paresis accompanying neuritis and perineuritis, galvanism (anodal) is very useful, and farado-massage applied when the acute stage is over.

In **facial paralysis** due to inflammation in the course of the portio dura the prognosis depends upon the extent of the lesion and its duration. In slight cases the muscles may recover without any treatment; but this result will be attained much more rapidly under mild faradization. Where the reaction of degeneration is present, the patience of the operator and subject may be put under a considerable strain; but galvanism (cathodal), with current-reversals and the faradic brush, will, in most cases, bring about a cure in the course of time. If the diagnosis be made at the beginning and announced to the patient, it may save later disappointment on account of the apparent want of results from the treatment. **Facial paralysis of central origin** is more serious in its prognosis than the peripheral form. Recoveries are comparatively rare, but improvement may be expected from systematic electrical treatment, with galvanization to the head and neck and polar applications to the affected muscles.

Spasms and contractures call for the sedative applications of the galvanic and faradic currents. Anodal applications in cases of **blepharospasm, convulsive tic, histrionic spasm, contractures following rheumatism,** are sometimes very successful; in others, complete failures. In the latter the spasm may be due to some source of reflex irritation, such as latent hypermetropia, or myopia, dental caries, etc., which should receive attention before attempting treatment by electricity. In **hysterical spasms and contractures** the faradic brush or static sparks are useful, especially if disagreeably painful. Spasm of muscles of deglutition may be due to a wisdom-tooth which is about erupting, and incision of the overlying gum will relieve it, perhaps assisted by a few applications of galvanism. **Hystero-epileptic** attacks may sometimes be broken up with the faradic brush or strong galvanic current. In **epilepsy** Erb recommends diagonal followed by longitudinal brain galvanization to affect the motor area in the cortex; then subaural and spinal galvanization, limited to the cervical region, and general faradization for their reflex effects. This is to be practiced between the attacks, in combination with the usual remedial and hygienic treatment.

In **writers' cramp** and other forms of co-ordination neuroses excellent results are afforded by rest and electromassage. Erb lays down the rule that the entire cerebro-spinal nervous system should be subjected to systematic electrization. First galvanization of brain and spine, then of the peripheral nerves. Faradization of the affected muscles is combined with massage. By the method of Wolff, in which this is systematically practiced, a number of cures have been reported.

In **tetany** galvanization of the spine and peripheral nerve-trunks and the anodal applications to the spine (Erb) have given good results. In **tetanus** proper, which is an infectious disease, not much can be gained by electricity, although spinal galvanization, with galvanization of the peripheral muscles, is said to have had a good effect upon the spasms. **Chorea** is benefited by weak currents, or by general franklinization or faradization.

Athetosis is said to have been improved by brain, subaural, and central galvanization, with currents from the spinal cord to the peripheral muscles (Liebig and Rohé).

Explanation of Production of Degeneration-Reaction Phenomena. — When discussing, on a previous page, the question of electrodiagnosis in paralysis, it was stated that there are important alterations in the electrical reactions. If a muscle be paralyzed by sectioning its motor nerve, or by the use of certain toxic agents which affect the nerve only and leave the muscular fibres healthy, we have a marked difference manifested in the behavior of the muscle under the electrical stimulus. For instance, instead of promptly contracting to the faradic current, we may find no response whatever when this (secondary or induced) current is used. With the galvanic battery, weak currents produce responsive contractions greater than in health, on making and breaking the circuit, or on reversing the current. With a stronger current, the muscle remains in a tetanic state of contraction while the current is passing, which is an abnormal phenomenon. Later, pathological changes occur, both in the nerve and in the muscle, due to removal of the influence from the trophic centres in the cord. When the lesion is destructive and irremediable, there is a gradual failure of galvanic, as well as of faradic, excitability of the nerve, ending in entire disappearance of the same in a few days. Before this is complete we have the following "degeneration reaction":—

An. Cl. C. > *Ca. Cl. C.* > *An. O. C.* > *Ca. O. C.*

This is well illustrated in a case of peripheral form of Bell's palsy, while the central or cerebral form of facial paralysis does not present this reaction.

Electrodiagnosis in Paralysis.—We may summarize with advantage the results of the electrical examinations in cases of paralysis:—

Normal electrical reactions accompany diseases of the brain or spinal cord (white columns).

Abnormal electrical reactions, differing quantitatively from the physiological standard, usually accompany lesions of the gray matter of the cord or the peripheral nerve-trunks. The character and extent of the lesion may be judged by the promptness of response to the electric current and by the presence of the reaction of degeneration.

Increased electrical reactions may accompany general hyperæsthesia of the nervous system, and, if accompanied by reflex contractions of muscles in remote parts of the body, it suggests increase of spinal excitability, such as occurs in strychnine poisoning, tetanus, hydrophobia, and other forms of disease. Should this phenomenon be restricted to a single muscle, or group of muscles supplied by a single nerve-trunk, the lesion is probably located in the afferent nerve. Dr. Haynes[1] sums up the diagnostic points in paralysis arising from disease of the gray matter of the cord as follows:—

"When the abnormal reactions are uniform, extending over an entire limb, the disease occupies a mass of its substance, as in the inflammation of the substance of the cord **(myelitis).**

"If they are confined to certain physiological groups of muscles the disease has generally been chronic and implicates the anterior roots of the spinal nerves, as in **progressive muscular atrophy.**

[1] "Electro-therapeutics," C. M. Haynes, M.D., Chicago.

"If the degenerate muscles react in an irregular manner, neither according to distribution nor function, the disease has usually been the result of an acute inflammation of the anterior cornua, which has destroyed some of the nutritive centres and left others intact **(poliomyelitis anterior)**.

"When a nerve is found deficient in response, and muscle normal, it shows alteration in the former, the latter remaining intact, as is sometimes seen in the early stage of **infantile paralysis.**

"The electrical reactions in peripheral paralysis indicate with exactitude the extent and distribution of the disease.

"When the electrical reactions are normal it indicates a paralysis of slight and temporary form; prognosis is favorable.

"Loss of response when either current is applied to nerve-trunks points to nerve-alteration, and this is in proportion to diminution of action.

"Loss of response to faradism, applied directly to a muscle, indicates changes in the intramuscular nerves without necessary alteration of the fibres themselves.

"Loss of response with galvanism applied to the muscles shows a modification or destruction of the muscular tissue, and this in proportion to the physical changes induced."

The indications for the different forms of current are also well summarized by the same author:—

"Galvanism is indicated in those cases in which we wish to excite the nerves of the skin, to destroy the outer skin or mucous membrane, to produce an increase of warmth, to produce a chemical process, and also blood-coagulation.

"In certain peripheral palsies in which faradism fails, galvanism, probably in consequence of its uninterrupted duration, produces effects which cannot be brought about by the necessarily rapidly-interrupted faradic current.

"When a muscle has lost all power of responding to the stimulus of a faradic current, in many cases its sensitiveness may be restored by the application of a tolerably strong galvanic current.

"Faradism is indicated where we wish to excite either the motor or sensory nerves, to produce contractions of the blood- or lymphatic vessels, to affect certain organs supplied by the sympathetic nerve. To increase the volume of a muscle: This it accomplishes through exciting muscular contraction, which increases the temperature and at the same time improves the nutrition. To relax a tense muscle, or to loosen a peripheral contractor, single shocks from a strong faradic current are generally more useful than the galvanic.

"Galvanism not only acts as a powerful stimulant to nerves and muscles when interrupted, but during the time it is passing without interruption it produces a marked alteration in the nutrition. To this effect Remak gave the name 'catalytic action.'"

When paralyzed muscles exhibit the reaction of degeneration they are more sensitive to galvanism than faradism; therefore the former should be selected to improve their nutrition. With this exception, faradism is a more powerful agent in the direct treatment of paralyzed muscles than galvanism.

According to Dr. Rockwell, in paralysis of one side of the body, or **hemiplegia,** when the muscles contract more readily under the influence of electricity than in health, electricity, if used at all, should be in the form of

a very mild **faradic** current; even though the muscular contractions are not excited quite so readily as in a normal condition, the faradic is still to be preferred. On the contrary, when the contractility of the muscles is very greatly diminished, the **galvanic** current is indicated, the faradic current being only employed after the muscles begin to contract under its influence. In most cases of paralysis of the lower half of the body, or **paraplegia,** there will be found, after a short time, more or less complete loss of farado-muscular contractility; the galvanic current alone is useful in these cases to restore nerve-excitability, although the faradic may be usefully employed to improve the impaired nutrition of the paralyzed members.

Paresis, or a condition of partial paralysis, is frequently materially benefited by electricity, both galvanism and induced currents being employed. Here we may again caution against the use of too strong currents and too prolonged administration. The contractions of the affected muscles should be slowly produced, so as not to fatigue the muscle or cause discomfort to the patient. In **constipation,** owing to defective peristalsis, often due to a paretic condition of the muscular tissue in the intestinal wall, very prompt effects can be obtained by either faradism or galvanism. In using the former a sponge-covered electrode, well moistened, is placed over some indifferent point upon the surface, or it may be held in one hand; the other (similarly prepared) electrode is passed around the abdomen in the direction of the large bowel, commencing at the right side, just over the cæcum, and gradually following the ascending, transverse, and decending colon to the sigmoid flexure. This may be accompanied by kneading the abdomen, or percussion (abdominal massage). For the application of galvanism an olive-shaped electrode may be passed into the rectum, the other being placed on the surface of the abdomen, in the form of a flat sponge. A moderately weak current, not strong enough to cause burning or other disagreeable sensation to the patient, is now passed, and the current broken and reversed several times a minute. If the constipation be simply due to inertia or paresis the effect will be prompt, pleasant, and highly satisfactory to both patient and physician. The treatment of **enlarged prostate** is conducted in much the same manner, with a specially-constructed electrode introduced into the rectum. When the middle lobe is especially implicated, we may obtain very satisfactory results from the use of an insulated electrode introduced into the urethra. In the treatment of **Graves's disease** "Cardew (*Lancet,* July 4, 1891) advises[1] a galvanic current, 2 to 3 milliampères, to be applied three times a day, six minutes to be taken in each application. The anode should be placed at the nape of the neck; the cathode should be moved from the mastoid process along the course of the great nerves. The electrodes are flexible metal, covered with wash-leather, three and a half inches in diameter for the anode, and one and a half inches in diameter for the cathode. Four Leclanché cells or three bichromate cells will suffice. Six Scholl's chloride-of-silver cells (dry) will be enough, and can be used by the patient in his home. The following directions are given: Thoroughly moisten the electrodes with warm water. Apply the anode to the nape of the neck, making firm pressure; apply the cathode to the mastoid, and move it up and down slowly along the sterno-mastoid muscle. Each application should last six

[1] *The University Medical Magazine,* Sept. 1, 1891.

minutes. Instructions can be written out for the patients, and they can apply the current at home. The author has used this means of treatment in a large number of cases, and believes it to be of great benefit in the vast majority of cases of Graves's disease. He has had failures, but it has been successful where other means have failed."

Electricity in Gynæcology—the Apostoli Method.—The convenience, cleanliness, and efficiency of electricity have combined to make it an indispensable adjunct to other therapeutic measures in various uterine and pelvic disorders, and, indeed, in some it has proved to be *the* remedy *par excellence.* In the reaction from the ultramechanical measures of a preceding generation and the ultrasurgical tendency of the present, thoughtful physicians have welcomed the treatment of many diseases of the uterus and adnexa which was introduced and practiced with such brilliant results by the late M. Georges Apostoli, of Paris. He first directed the attention of the profession to the treatment of endometritis by the use of galvanic currents of a strength previously unheard of in medical annals. By means of what he termed the "chemical, galvanocaustic current," of from 100 to 300 milliampères, he succeeded in checking hæmorrhage, relieving pain, removing chronic inflammatory products, producing involution, and restoring normal function and condition. The method can best be explained in discussing its therapeutical applications. The principal peculiarities of this method have already been alluded to, and they are well illustrated in the following brief statement of its applications:—

In **endometritis** attended by much hæmorrhage or other discharge Apostoli used a metallic sound insulated, except at its termination in the uterus, by a celluloid sheath or cannula. The active portion of the electrode is of platinum or of gold, so that it will not be corroded by the decomposing fluid when used for the positive pole. Dr. A. H. Goelet, of New York, has devised a set of graduated, interchangeable, non-corrosive steel tips for this purpose, which are durable and comparatively cheap. Dr. Walling has used gas-carbon tips, which are easily replaced if broken; they are made from carbon points (such as are used in the ordinary arc lights), and are affixed to a stout copper wire, which may be insulated with rubber varnish or by melted shellac. Dr. Andrew F. Currier, of New York, employs vaginal and uterine electrodes of aluminum with a cylindrical, removable tip of platinum, the shaft being covered with thin rubber tubing. These possess the advantages of lightness, flexibility, and comparative cheapness. The second electrode of Apostoli is a large flat surface of moist clay, which admits of accurate molding to the abdominal wall. If it is not snugly fitted, under the effects of high currents it may cause pain and even blistering of the skin. The objections to Apostoli's clay electrode are that it is heavy, awkward to handle, and dirty. This may be obviated to some extent by the plan of Dr. Goelet, of New York, in which the clay is made into the consistence of putty and rolled flat; it is then enveloped in a layer of absorbent cotton and covered with linen crash; finally, a sheet of rubber cloth is fastened to the back, by means of which it may be handled and the patient's clothing kept dry. The metal contact plate is pressed into the clay underneath the cotton, and a binding-post extends through the back, by which the apparatus may be connected with the appropriate cord. Another device for the same purpose has been adopted by Dr. Franklin H. Martin, of Chicago, and it consists of a concave, metallic, nickel-plated electrode, the

lower surface of which is a sheet of membrane surrounded by an insulated rim to prevent the plate from coming in contact with the skin. When used, about a pint of warm water is poured into the interior through a central opening in the plate, which is then closed with a screw-cap. The transudation of the water through the membrane produces a moist surface for contact with the abdominal wall. This apparatus is cleanly, and it is claimed by Dr. Martin to be capable of transmitting very heavy currents without pain or local action upon the skin. The strength of current employed by Apostoli should not be maintained long,—the duration will depend upon the character of the case; usually it lasts from three to ten minutes, and not repeated oftener than once a week or every ten days. For several days after the application more or less sanguinolent and serous discharge may come from the uterus, but unless antiseptic precautions have been neglected fever is not likely to be manifest. The number of sittings required for a cure will vary very greatly according to the chronicity and condition of the case.

Hæmorrhages from the Uterus.—Apostoli called the positive electrode "the hæmostatic pole," and in persistent hæmorrhages he employed positive electrization by the intra-uterine sound, the negative being connected with the abdominal large plate electrode. Dr. G. Betton Massey reports several cases in which currents of from 40 to 50 milliampères were curative in a few applications. When heavier currents are used, he advises having two flat electrodes, one on the abdomen and one at the back of the patient, both connected with the same electrode, thus very much reducing the liability to production of pain. The applications may be made every two or three days. There is, probably, no agent of the materia medica which will check hæmorrhage so effectively and promptly as the positive pole; and it is far preferable to the ordinary mineral or vegetable astringents or styptics. Even in cases of myoma or cancer the effects of the positive pole have been highly successful, while in ordinary menorrhagia, due to pathological conditions of the mucosa, it is curative after a few applications, both of the hæmorrhages and the **chronic leucorrhœa.** In such cases swelling currents to 200 or 250 milliampères are employed.

For the relief of a **painful condition of the uterus or ovaries** the positive pole is used as above, but the current need not be more than 20 to 30 milliampères, rarely as high as 50 milliampères. The applications, however, should be more frequently made,—every day at first,—*séances* lasting from five to eight minutes. In some cases this expedient will gain time and afford temporary relief while the patient is being prepared for surgical operation. On the other hand, if an operation has been performed and the ovaries removed, pain may still persist, and here electricity will meet the indication better than any other resource.

Uterine Cancer Treated by Electricity.—The good effects Apostoli had in the treatment of myomata with electricity led Dr. Wernitz,[1] of Odessa, to use it in carcinoma of the uterus. He reports four cases of carcinoma of the uterus in which he employed the galvanic current. The results he reports are the following:—

1. Complete cessation of pain. Patients who could only be eased with strong narcotic remedies enjoyed, after a few applications, complete freedom

[1] *Berliner klinische Wochenschrift*, Sept. 22, 1890.

of pain, good appetite, and sound sleep, in consequence of which their general condition improved.

2. The discharges were decidedly reduced in quantity and hæmorrhage ceased.

Whether a complete cure or cessation of the cancerous processes could be expected after a long-continued application of the galvanic current, Dr. Wernitz does not venture to state. The favorable results so far gained by him he ascribes to the chemical and electrolytic action of the current.

Sterility may result from many causes. If it results simply from imperfect development or defective nourishment of the uterus and ovaries, or to catarrhal endometritis, electricity is of decided value. In the former case, faradism, systematically applied, two or three times a week in the intermenstrual periods, will stimulate development, and, in the latter, galvanic currents of mild strength will remove the cause.

Dysmenorrhœa may also be caused by defective development, and faradism systematically applied will afford marked relief. Where mechanical causes exist, the discovery of their nature may suggest other expedients, but the intra-uterine negative electrode, with weak galvanic currents, will produce excellent results as regards the relief from pain and discomfort. **Inflammatory exudation,** the result of peritonitis, may incarcerate the uterus and ovaries and make them immovable. This is capable of amelioration, or cure, through absorption of the exudate, according to the Apostoli method. In **subinvolution,** which may be attended by pain, sterility, and menstrual disorder, or hæmorrhage, faradism is very useful, but weak galvanic currents (20 to 30 milliampères) will materially assist in restoring the organ to a normal condition. In all cases of hypersecretion from the uterine mucous membrane, the positive galvanic pole is promptly efficient in overcoming this condition.

It is, however, in **uterine myoma** (or **leiomyoma**), **myofibroma,** and **fibroma** that the Apostoli method comes in direct opposition to the practice and teachings of the surgical gynæcologist. It certainly should be borne in mind, throughout the discussion of the therapeutics of this form of neoplasm, that its life-history is not well known. The original cause of the growths has not been discovered; they may remain for years of about the same size and then suddenly take on renewed growth, or they may undergo involution and become the seat of degenerative changes. In many cases, especially if small, they may cause but little discomfort, and may be quite accidentally discovered during life or post-mortem; in others they are, without reference to their size or number, accompanied by congestion, hæmorrhage, and various symptoms of disorder calling for relief. The submucous variety tends to become polypoid, and readily admits of detection and removal; the intramural and subperitoneal forms, on the contrary, are less easily recognized, and require a more serious operation for their relief. These growths are now scientifically treated by the method of Apostoli, which has the indorsement of some of the best authorities, such as Sir Spencer Wells, Keith, and many others equally well known as competent to decide upon the relative merits of electricity and laparotomy.[1] A very temperate summing

[1] Additional evidence as to the value of his method, collected from English and American sources, was published by Dr. Apostoli in "Travaux d'Electrothérapie Gynécologique." Drs. Thomas Keith and Skene Keith state that during more than two years in which they had employed Apostoli's methods they had not performed a single laparotomy for uterine fibroma.

up of the present subject of controversy may be given in the words of Massey:—

1. A properly-conducted electrical treatment of solid fibroids is harmless, will remove the irritation and pain due to their presence, arrest further growth, and almost invariably cause a gradual diminution in their size.

2. Bleeding fibroids may be entirely cured of the hæmorrhagic tendency and pain, arrested in growth, and gradually lessened in size.

3. It is possible for the diminution in the size of the tumor to end only in its complete disappearance.

4. In small intramural fibroids surrounded by unimpaired uterine tissue, the current applications tend to promote their disengagement from the uterine stroma and extension either into the uterine or peritoneal cavity. In the former case a complete cure may result by delivery of the tumor, and in the latter case a lessening of its symptomatic importance.

5. The time necessary for a satisfactory shrinkage should not be too sparingly measured with the slow cases. Quick symptomatic cure and slow shrinkage are often associated in the same case.

6. In fibroid tumors that have undergone cystic degeneration a treatment by strong currents may do harm, being apt to set up changes in the liquid contents of the cavities that may result in septicæmia.

A uniform result in Massey's experience is that the first two or three applications, even if strong ones, do not usually cause an appreciable diminution in the size of the tumor, but a striking and almost inevitable consequence is a prompt disappearance of any tenderness about the mass. If this does not occur, it will be found, as pointed out by Apostoli, that some pronounced disease of the appendages co-exists. Fetid or too abundant leucorrhœa is promptly relieved after a few applications. There is also a marked improvement in the general physical health of the patients under this treatment; the abdominal walls increase in adipose, the appetite and digestion improve, the bowels become more regular, and the chronic invalid finds himself restored to health and usefulness.

It is proper to state, however, that some observers have not had as happy results with electricity as those just named. Dr. John Homans,[1] of Boston, communicated his results in 34 cases of uterine fibroma, in only 2 of which had the size of the tumor diminished. The general health had improved in 15 cases, had been worse in 2, and 1 death was attributed to the treatment. Profuse hæmorrhage had been diminished to a normal or bearable degree in 9, had been increased in 6, and unchanged in 9. Locomotion had been made easier in 16 cases and more tiresome in 5. Pain was lessened in 6 cases, increased in 2, and unaffected in 5. The menopause occurred in 4 cases after treatment had been begun. In consequence of such unsatisfactory results Dr. Homans discontinued the use of electricity in this class of diseases in favor of abdominal section. It is well known that the late Lawson Tait was an outspoken antagonist to the Apostoli method. It is impossible to reconcile the conflicting reports as to the relative value of these two radically-different plans of treatment; but it may be admitted by both parties to the dispute that electricity can never be practiced successfully by the general practitioner, unless he knows more about electrical science than the average physician does. Just as special skill is required to perform an abdominal

[1] *Provincial Medical Journal*, June 1, 1891, p. 362.

section for removal of the uterus and appendages successfully, so we may acknowledge that treatment of uterine fibroma requires special skill and knowledge. We also may conclude that at present the data are wanting which would enable us to say, at the beginning of treatment, which cases require surgical interference and which are proper subjects for electrical treatment. It is claimed by Joseph Price that, in cases which come ultimately for operation after a more or less prolonged course of electricity, the operation is rendered more difficult, and that adhesions result directly from the treatment. Just here there is irreconcilable antagonism between the advocates of the two methods. Apostoli claimed good results upon diseased condition of the uterine appendages. Dr. Willis E. Hallowell,[1] advocating this treatment, says: "When we find the tubes and ovaries alone inflamed, excepting for the present, at least, those cases in which they contain pus or other fluid, hydro- and pyo- salpinx, ovarian abscess, and cystic ovaries, we have in galvanism a very efficient curative agent. I have seen a number of tubes about the size of the little finger, more or less hard and very tender, become of normal size, consistency, and sensibility; and likewise ovaries, variously enlarged, prolapsed, and exquisitely tender, become of normal size, and, in many cases, return to their normal position."

The advice of this writer is much to the point. If pus or other fluid be present and its infective character be made probable by recency of occurrence, by fever, or by repeated attacks of pelvic inflammation, laparotomy is indicated, and at once. He further declares that if we can satisfy ourselves by good evidence of the existence of a closed collection of fluid, even though we have no evidence of its virulence, it is advisable to remove it by operation. Laparotomy may even find an ally in electricity. The good effects of the latter upon the general health and nutrition may place a patient in better condition to pass through the ordeal of a capital operation; on the other hand, an operation may fail in its good results owing to cellulitic exudation, which can be removed by subsequent electrical treatment. He concludes by the statement of his "conviction that we have in electricity an agent which, with careful study of what is already known and future investigations, will become, in the hands of a good electrician and a thorough gynæcologist, one of the most important weapons in the struggle against disease in woman, though it can hardly become the panacea which many of its advocates have claimed it to be."

Just what is claimed by the advocates of electrical methods may be learned from a communication read by Dr. Apostoli at one of the International Medical Congresses, of which the following summary presents the leading points:—

1. The constant galvanic current is indicated principally in gynæcology, in endometritis and fibroma; of paramount value in vascular derangements and pain (amenorrhœa, dysmenorrhœa, and metrorrhagia); it is also a potent means for arresting the growth of benign neoplasms, and promoting the absorption of periuterine exudations. It exerts a very salutary resolvent action in periuterine phlegmasias, and in some cases of catarrhal ovarosalpingitis; but it is inefficient and even does harm in high dosage, especially if the negative pole is used in the uterus, in suppurative phlegmasias of the appendages. This variable intolerance, which is increased by an inflam-

[1] *Northwestern Lancet*, 1891, p. 85.

matory condition of the appendages, proves a valuable means of diagnosis in determining the existence and character of periuterine, liquid effusions (sanguinolent or purulent), which have been unknown or merely suspected, and hastens in these cases a delayed or refused operation.

2. The effects of the constant galvanic current are polar and interpolar. The trophic and dynamic interpolar action, which increases as the square of the given intensity, is distinct from the polar action; this action, as Apostoli has shown us, differs according to the pole used, giving us the calorific action produced by the passage of the current (to increase interstitial circulation), and, finally, the antiseptic action of the positive pole, the experimental demonstration of which has been given us recently by Apostoli and Laguerrière.

3. Galvanic applications in high dosage, used in varying amounts from 50 milliampères upward, dependent upon the tolerance of the patient or the clinical indication, are the fundamental basis of Apostoli's method, and present the following points in their favor: (*a*) The utilization of vascular drainage, a direct effect of the calorific action due to the resistance to the passage of the current, and in direct proportion to the square of the intensity. (*b*) The antiseptic or microbicidal action, which increases with the given intensity. (*c*) The rapidity and efficacy of the results produced, which are in proportion to the square of the electrical energy, the formula for which is analogous to that of the measure of the energy of other natural forces: $Q = {}^1/_2 m V^2$. (*d*) The general applicability of this method to refractory cases (painful and subperitoneal fibromata, fungous endometritis, etc.), and to young women. (*e*) The infrequency of relapses, which, all things being equal, are least apt to occur when the strongest currents have been employed.

4. If the vaginal application of the galvanic current (which is the method proposed by Chéron for fibromata alone, and used since by A. Martin, Brache, Ménière, Onimus, Carpenter, Mundé, and others) gives any results, they are very inferior to those of the intra-uterine application, which should always be the method of choice: (*a*) Because it utilizes the maximum of the given current and its energy. (*b*) Because it utilizes the antiseptic action of the positive pole, which is entirely local, and is not present in the interpolar circuit or at the negative pole. (*c*) Because it adds the derivative and caustic action of the intra-uterine application, treating thus at the same time the simple endometritis, or the secondary endometritis, which so often complicates fibromata and periuterine phlegmasiæ, thus insuring a more rapid, complete, and permanent cure. (*d*) Because it is more effectual than the vaginal application in relieving pain and producing a tolerance for higher dosage, and, by thus allowing the use of currents of increasing intensity, the vascularity is increased and the best results are attained.

5. Vaginal galvano-punctures, 2 to 5 millimetres (one-twelfth to one-fifth of an inch) in depth, made with a filiform trocar of gold, insulated throughout except at the point, are a very useful complement to the intra-uterine treatment proposed by Apostoli, by better localizing the galvanic action, and by increasing, in some cases, the efficiency of small and medium doses.

The innocuity of his intra-uterine applications is proved: First, by the parallel innocuity of the chemical and other harsh methods of intra-uterine treatment; secondly, by the statistics gathered from all parts of the world, and particularly by his own statistics, which he has widely published.

Details of Operation.—The apparatus required are a good battery or

source of electrical energy, capable of maintaining a current up to 250 or 300 milliampères when the body of the patient, a rheostat, and a milliampèremeter are in the circuit. The electrodes have already been sufficiently described. It may be stated, however, that for applications of less than 100 milliampères the clay abdominal electrode may be substituted by towels wrung out of hot water or wet absorbent cotton laid upon the surface, upon which the lead plate to which the electrode is attached may be placed. The intra-uterine electrode, as pointed out by Massey, should be insulated nearly to its extremity, leaving only about two and a half inches exposed, so that it shall not cauterize the cervical canal and thus induce subsequent stricture. This electrode should be so constructed as to permit of thorough cleansing and boiling for several hours before it is used.

The battery should be tested prior to operation and the milliampèremeter examined. This is done by placing all the cells in action and gradually turning on the controller, while watching the effect upon the meter. The controller should then be reversed until the current is entirely cut off, when the apparatus is ready for use in the operation. The conducting-cords should be carefully examined, so as to detect any possible break. Determine the proper size and curve of the sound, and properly disinfect it. The curve is best made with the aid of an alcohol-lamp, and while the sound is heated the insulation may be secured by applying gum-shellac in such a way as to cover all breaks and weak spots. Arrange the gynæcological table or couch so that it will be convenient to hold the sound in place with the left hand, leaving the right hand to manage the current-controller.

The patient should be informed of the character of the operation and of the necessity of keeping absolutely still, so as to avoid shock or disarranging electrodes or wires. The application should not cause pain beyond a slight burning, and the patient should at once inform the operator if the current causes more pain than this, when the current can be promptly diminished by the controller. The bowels should be evacuated by a purgative, followed by an enema, and the vagina should have a preliminary irrigation with an antiseptic solution shortly before the operation. If there should be any pimples or abrasions on the surface of the abdomen they should be covered with small pieces of waxed paper, or paper smeared with vaselin or lard upon the surface next to the skin. The details are further described as follows (abbreviated from Massey):—

Placing the Electrodes.—1. Apply the clay (or the Martin) electrode smoothly upon the abdomen, and attach to the binding-post the cord of the plate which is desired to be indifferent.

2. Attach a disconnected conducting-cord firmly to the intra-uterine electrode, and insert it as any other sound is inserted, using all the precautions recommended in the passage of this instrument. At first it may only be possible to introduce a filiform, flexible instrument, but after a positive cauterization subsequent introductions will be easier, and larger instruments may be used. A speculum, as the rule, is not needed, as the sound should be guided by the finger alone in its introduction; it should be held firmly in place by the left hand during the passage of the current, the finger being in the vagina.

3. After seeing that the connections are all right and the controller at zero, the cord of the intra-uterine electrode should be attached to the binding-post of the pole that is to be active. The patient now being ready, the

current is slowly turned on, until 30 or 40 milliampères are shown by the meter. After resting at this point for a few minutes 10 or 20 milliampères may be added; but, as the rule, 40 or 50 milliampères will suffice for the first treatment, especially if the patient be nervous. The meter should be constantly watched, as well as the patient's countenance, and on the first sign of pain the current should be reduced by the controller. The active electrode may be moved, so as to bring it in contact with all parts of the endometrium, care being taken not to perforate the fundus. The current is maintained at its maximum from two to ten minutes, and then gradually lessened. When heavy currents are used (200 or 300 milliampères) the time should be shortened, except in tumor cases. The decrease of current should be gradually produced by slowly reversing the controller until the needle of the meter falls to zero. The sound is then removed, and the abdominal plate taken away. It is best to have the patient rest awhile before going home, particularly if she is obliged to walk. Massey insists that, in every case where at least 100 milliampères have been used, the patient should lie down immediately upon reaching home, and remain inactive during the remainder of the day, so as to avoid inflammatory reaction. There will be sanguineous, followed in twenty-four hours by a purulent, discharge, and there may be some colicky pains, but the recumbent posture, with antiseptic vaginal irrigations twice daily, will soon cause these to subside. For the treatment of many cases of endometritis, unaccompanied by hyperplasia, currents of 20 to 30 milliampères are quite sufficient, while the heavy currents are especially required in tumors, large hypertrophy, or inflammatory exudation. Three times a week is as often as the operation can be performed with safety; in many cases twice, or even once, a week will suffice.

Dr. Massey gives the following contra-indications to operations under the Apostoli method:—

1. The presence of the menstrual flow.
2. The existence of acute metritis or perimetritis.
3. The co-existence of abscess anywhere in the pelvis.
4. Pregnancy.

Faradism in Gynæcology.—Apostoli used the faradic current in acute inflammatory affections of the uterine and periuterine tissues and appendages. No stage of the inflammation, even the most acute, contra-indicates the employment of the current. The bipolar vaginal electrode may be used, applied in the neighborhood of the severest local pain. (Liebig and Rohé.)

In **amenorrhœa** both galvanic and induced currents are employed. It is not necessary to apply the electrodes locally to the uterus or ovaries, since experience has shown that electricity applied to a distant portion of the body will increase the menstrual flow, or stimulate it if arrested (except in pregnancy). The faradic current is employed in general faradization, dorso-abdominal with the dry brush to the abdominal walls, the inner sides of the thighs, and also to the soles of the feet.

In **obstructive dysmenorrhœa** Apostoli used faradization with a bipolar electrode, the strength being regulated by the feelings of the patient. **Congestive dysmenorrhœa** may be relieved by weak currents, either intra-uterine (Apostoli) or with the wire brush to stimulate the cutaneous circulation over the abdomen, while galvanism from the cervix to the spine (anode to cervix, cathode externally) may be combined with advantage. The same treatment is advised for painful ovaries and **nervous dysmenorrhœa**; also for non-

periodic or constant pains in the pelvis. Daily, or even twice a day, is not too often for the application of faradic currents, which should be extremely rapid and perfectly smooth, in order to obtain the sedative effects.

In **threatened abortion** an insulated vaginal electrode may be placed against the os and a soft sponge electrode applied over the hypogastrium or lumbo-sacral region for ten minutes at each sitting, using mild, smooth currents. Dr. W. T. Baird, of Texas,[1] used it in three cases, in which he succeeded in arresting hæmorrhage and preventing the expulsion of the ovum, the patients afterward going on to full term. To arrest hæmorrhage after abortion, owing to a relaxed uterus, the same current may be employed, either in the same manner or by using a double uterine electrode, by means of which the current can be definitely localized in the uterus and produce more forcible contraction (Liebig and Rohé). Even in **placenta prævia** the faradic current is recommended, as strong as can be borne, in order to produce strong equable contractions of the muscular fibres. Dr. Baird claims that **during parturition** faradism is a valuable agent for relieving suffering, and may take the place of chloroform. He uses the mediate method, one electrode being placed over the patient's sacrum, the other being attached to a wristlet upon the operator's arm; he then passes his hand over the patient's abdomen during the pains. **Premature delivery** may be brought on by very strong currents, either faradic or galvanic.

Vomiting of pregnancy has been treated by Bordier and Verney[2] by simultaneous galvanization of both vagi. The method adopted is to have a flat metal electrode (covered with wash-leather) of about ten square inches, placed over the epigastrium, while two small electrodes are set on the sides of the neck between the lower bundles of the sterno-mastoids. The latter are connected with the positive pole. The current should be gradually increased or decreased, avoiding shocks. The strength of the current should be 10 to 20 milliampères. Food is taken, such as a glass of milk sipped slowly during the application, and the current is increased if nausea appears.

Agalactia, or **deficient secretion of milk** after delivery, yields promptly to faradic stimulation of the mammary glands. Dr. Fry reported a case of suppressed lactation in which galvanism was employed with complete success, only two applications being required. The active electrode (cathode) was made of sheet lead, three by five inches, molded so as to fit over the breast, and covered with absorbent cotton. The anode was placed at the back of the neck. An average current of 10 milliampères was passed for eight minutes through each breast.

Involution of the uterus after labor is hastened by faradization, according to Apostoli and Tripier. Septic infection is thus prevented by securing contraction of the organ. The lumbo-abdominal method is usually sufficient, with daily sittings for a fortnight, or longer if necessary.

In disorders of the male genito-urinary organs electricity is largely used with marked success. In paralysis, hyperæsthesia, stricture, functional impotence, all three forms of electricity may be employed locally.

Paresis or **paralysis of the bladder** resulting from various causes, with retention or incontinence of urine, is often markedly relieved. An insulated urethral electrode is passed into the bladder, the other electrode being placed over the perineum, hypogastrium, or lumbar region, and a current passed

[1] *American Journal of Obstetrics*, April, 1885, p. 341.
[2] *Archives d'Electrothérapie Médicale*, May 15, 1898.

as strong as the patient can bear, gradually increasing the length of the sittings, though not exceeding ten minutes. The bladder should be partly filled with a weak borax solution, so as to diffuse the current during its passage; and if there should be decomposition of urine with cystitis, irrigation of the bladder should be practiced once or twice daily, with mild antiseptic solutions.

In **nocturnal incontinence of urine** faradism is very successful, one electrode being placed in the lower dorsal region of the spine and the other over the pubes, or an insulated urethral electrode may be introduced as far as the neck of the bladder.

Functional impotence, spermatorrhœa, and **frequent nocturnal losses** may be relieved in a similar manner to that just indicated for nocturnal incontinence of urine. In addition, the wire brush may be applied to the external genitalia and to the inner side of the thighs, especially in functional impotence and feeble erections. Mild galvanic cathodal applications to the neck of the bladder will also markedly reduce irritability and arrest the discharges in spermatorrhœa.

Faradism in Renal Colic.—Dr. Carl D. S. Früh, of Philadelphia,[1] relates the case of a man, aged 48 years, who was taken severely ill on June 22, 1900, with pains in the left kidney. He gave a history of three previous attacks in which the pains were so bad that he went into convulsions. The regulation treatment with morphine and atropine failed to give more than momentary relief. He was then placed on his side with the sore kidney up, the hip and legs elevated, and a faradic current, with interruptions of from sixty to eighty per minute, was applied to the front and back of the organ. One-half hour of this gentle tapping of the kidney eased the pain completely. The patient passed water freely and was entirely relieved by this treatment.

In **hypertrophy of the prostate** Tripier recommended an insulated sound in the urethra and one in the rectum, with the faradic current. An electrode of special shape for the rectum has been made, at the suggestion of the author, for application to the base of the bladder and prostate, the neutral electrode being placed over the abdomen.

The high-frequency currents, according to d'Arsonval, confirmed by Apostoli, is efficacious. Owing to its action upon the cell-function, it modifies general nutrition, promoting and regulating it. The clinical result claimed is a progressive restoration of general health. Tests of the urine show increased activity in organic combustion, improved diuresis, and easier elimination of excreta, the proportion of uric acid returning to normal. It is, therefore, of great value in gouty neuralgias, neurasthenia, dyspepsia, eczema, vascular congestions, and manifestations of lithæmia. In chronic forms of rheumatism and gout it is useful, but not in the acute forms.[2]

In **enlarged lymphatic glands,** when suppuration has occurred, the galvanocautery affords an ideal method of opening glands. The wire-point cautery may be employed to make punctures into the substance of enlarged glands, the gland-structure being partly destroyed and partly condensed or absorbed under the action of the negative electrode (5 to 20 milliampères twice weekly). Strong, frequently interrupted **faradic currents** have also been found useful in enlarged lymphatic glands.

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[1] *Medical Record*, August 11th; *New York Medical Journal*, Sept. 22, 1900.
[2] *Journal d'Hygiene*, Paris, July 13, 1899.

In **orchitis**, after the acute stage has passed, percutaneous galvanization, followed by faradization, reduces swelling and promotes absorption. In **atrophy of the testicle** faradism with the dry brush and descending galvanic currents to testicle and spermatic cord will increase the circulation and favor nutrition. In **hydrocele** percutaneous applications of both forms may be practiced, but the effect is more prompt, according to Liebig and Rohé, if the sac be punctured with a needle-electrode (cathode), using a current of 20 to 50 milliampères to produce electrolysis.

Application of Electricity in Dermatology.—Various morbid conditions of the skin are susceptible of marked amelioration under the action of the several forms of electricity.[1] Only a few of the principal applications can be mentioned here.

Various nervous disorders, pain, hyperæsthesia, anæsthesia, œdema, urticaria, and neurotic bullous eruptions are successfully treated by galvanism or faradism. General electrization (electric bath, static "breeze," etc.) is valuable in neuroses with cutaneous manifestations. **Itching**, or **pruritus**, which is such an annoying accompaniment to various lesions, is promptly, if not permanently, relieved by swelling faradic currents. Static electricity has been used with success by Leloir in obstinate cases of paræsthesia, especially when the anal and vulvar regions were involved. Raynaud's disease (local asphyxia), it is claimed, may be checked and the angiospasm permanently arrested by a strong faradic current. In a similar manner **chilblains** or **pernio** may be benefited. In either, if trophic symptoms are present, the combined treatment with galvanism and faradism is useful. Dr. Hugo Helving employs galvanism with excellent results in the treatment of frost-bitten nose, applying both poles to the sides of the nose and passing a moderately strong current for five or ten minutes, moving the electrodes slowly at the same time. Static electricity removes the pain and soreness of a superficial burn.

In various forms of inflammation of the skin, electricity may be judiciously employed, especially in the more chronic forms. In **eczema**, the author sees the best results from the faradic current applied by a metallic ball electrode. Anodal galvanic applications also give good results in acute forms, while in the chronic form with much infiltration the cathode is preferable. In **herpes zoster** galvanism gives better results than faradism. The anode to the spine and the cathode along the distribution of the affected nerve, with mild currents, generally relieve the pain and check further eruption. It is also valuable in the treatment of the resulting intercostal neuralgia.

In **alopecia** the dry faradic brush over the bald spots is often beneficial. The drawing of sparks with a static apparatus is recommended by Ranney and others. **Acne** may be similarly treated with the faradic current, or galvanism may be applied with anode to back of neck and the cathode to the seat of eruption. In **rosacea** Dr. Hardaway practices electropuncture: introducing a delicate needle into the enlarged veins and connecting it with the cathode, a current (of 1 or 2 milliampères) is passed through the needle, causing coagulation of the blood and occlusion of the vessel. Multiple galvanopunctures of the hypertrophied skin will greatly promote resolution.

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[1] For further clinical experience see author's work on "Diseases of the Skin." New York: D. Appleton & Co., 1901.

In **keloid, hypertrophied scars, cicatrices,** etc., the same authority has obtained the best results from galvanopuncture. **Warts, moles,** and **small fibromata of the skin** yield readily to the same treatment without leaving disfiguring scars. Currents of 2 to 6 milliampères are used. A small **nævus telangiectasis** is successfully treated in this way, the negative needle being thrust in various directions through the base of the growth. **Cavernous angiomata** and **vascular nævi** are less amenable to this treatment, but with judicious management and patience complete success may follow the application of this method. The galvanocautery may be used in removing such a growth. The x-ray treatment of skin disease is discussed (on page 999) in connection with Roentgen rays.

Removal of Superfluous Hair.—Electrolysis is now very generally employed in destroying hair-bulbs and removing hair growing in abnormal situations. First employed by Dr. Michel, of St. Louis, in **trichiasis** with successful results, the method was afterward extended by Dr. Hardaway to the removal of superfluous hair in any situation. When properly used this method causes neither pain nor disfigurement, but permanently removes the source of the trouble. The method is easy and the instruments are few in number; a battery capable of yielding a current of from $^1/_2$ to 2 milliampères, a needle-holder armed with a No. 12 sewing-needle of steel or alloyed platinum (the latter being preferable because flexible), and a sponge electrode are all that are required. It is convenient to have the patient sit in a chair with a good head-rest during the operation, and the operator may find it necessary to use a good hand magnifying-glass to enable him to introduce the needle directly into the hair-follicle by the side of the hair. The needle being attached to the cathode, the current is made to pass by the patient touching, with his disengaged hand, the sponge of the electrode held in his other hand. The effect of the current will be immediately observed; the tissues around the needle will be slightly raised up, and froth will issue from the mouth of the follicle. In about half a minute the hair should be gently pulled with the tweezers or cilia forceps; if it does not immediately come away the current should be passed a short time longer. The circuit is broken by removing the hand from the sponge, which gives less pain than if it be broken or closed with the needle. A sitting should last not longer than fifteen minutes, and the hairs destroyed should not all be from one spot; otherwise there may be some inflammatory reaction, or even sloughing and production of scars. After the operation a mild astringent lotion is ordered and applications of hot water directed to be made several times daily to reduce hyperæmia. If the operator has been successful in destroying the papilla the hair will not return, but in a certain proportion of cases the papilla escapes destruction and the hair is regenerated. This may be due to a twist in the hair-shaft in its passage through the skin, and partly to inexpertness on the part of the operator. Some hairs may require repeated removal before the papilla is finally destroyed. In young persons, especially, new hair-papillæ are constantly developing in the skin, and the appearance of new hairs after operation does not, therefore, mean that the operation was a failure. Such patients it is necessary to warn before operating that new hairs may appear though the older ones were destroyed by the operation. In young individuals the process may have to be repeated several times before the operation is finally crowned with success. The needle-holder of Hardaway is a good instrument, but one has recently

been devised by Leviseur which is a decided improvement. In this instrument the needle can be held either directly projecting in a straight line or at an acute or obtuse angle with the handle. The operator holds the instrument like a writing-pen, with the needle at the proper angle to enter the follicle with the greatest readiness.

Electricity for Preventing the Loss of the Hair, Premature Grayness, Calvities.[1]—The object of treatment is to promote nutrition of the scalp and hair-bulbs. This is promoted by the practice of massage, the use of hot, alternating with cold, douches, by the shampoo with either hard or soft soap, and, above all, by electricity. Both galvanism and faradism have been employed, and both are efficacious. The uninterrupted current should, in the beginning, be a mild one, not exceeding 3 or 4 milliampères. It may be applied by moistened sponge electrodes, the hair also being moistened and parted at intervals. An excellent mode of administering the current is through a brush with metallic bristles. Faradic electricity is conveyed in the same way through a wire brush, the patient holding the moistened sponge electrode. The brush is to be passed over the scalp slowly until the skin becomes quite red.

Removal of Foreign Bodies from the Eye with the Electro-magnet.—One of the neatest applications of practical electricity to medical purposes is seen in the removal of pieces of iron or steel from the interior of the eye with the electro-magnet. Several forms have been devised since the instrument of Professor Hirschberg, of Berlin, was first introduced, in 1855, varying in slight details, but all consisting essentially of a fine insulated wire coil with a core of soft iron, to which is attached a tip, also of soft iron. After closing the circuit, the current being furnished by a single galvanic cell, the point of the instrument is brought to the edge of the wound, or, if the foreign body be deeply imbedded in the eyeball, it may be necessary to puncture the sclerotic and introduce the point of the magnet until the substance is attracted by it and removed from the eye, the current not being broken until the instrument is free from the eye. Of course, only particles of iron and steel can be removed by the magnet, but, as they frequently find their way into the organ, it is an admirable contrivance, since the foreign body may be removed without causing further irritation.

Dr. Casey A. Wood, of Chicago, reported a case of electro-magnetic extraction of a piece of steel from the vitreous chamber of the eye, with preservation of sight. The magnet used is known as Snell's, manufactured by Meyrowitz Brothers, of New York. With this he prefers a small two-volt storage cell, which is more portable than the ordinary acid cell, and is very efficient. The details of this case are quite instructive. Atropine solution had been instilled into the eye, shortly after the injury was received, by the attending physician, and Dr. Wood saw the patient seven hours after the accident. There was a penetrating wound of the cornea and iris, and the anterior chamber contained blood. No clear view could be obtained of the fundus. It was decided to wait until the effused blood had undergone absorption. The conjunctival sac was thoroughly disinfected, more atropine instilled, and the eye dressed with boric-acid powder and a bandage. Three days later a wound in the lens could be plainly seen through the dilated pupil. Two clots were seen in the vitreous; only portions of the

[1] See article by author on the "Hair with the Toilet. Care in Health and Treatment in Disease," *Medical Bulletin*, Philadelphia, April, 1892.

fundus could be seen. It was decided not to attempt removal of the foreign body through the original wound. Four days after the accident "the patient was anæsthetized and a straight equatorial incision (eight millimetres long), was made with a Graefe knife through the sclera, about a centimetre behind the limbus, at the lower outer quadrant of the hemisphere. Another wound of the same length, but at right angles to this, was first carried through the conjunctiva and Tenon's capsule; so that when both wounds were closed the vitreous chamber was effectively shut off from the outside air. A bent and flat needle was carefully introduced into the vitreous, and, after several reintroductions and 'fishing' about, a small bit of steel was withdrawn, attached to the tip of the magnet-end. Little or no vitreous was lost. A few stitches were put through the conjunctival flaps, and the eye was again dressed with boric-acid powder. The greatest care was observed as to the use of antiseptics, and the wound healed without the least difficulty." The extracted metal weighed 17.7 milligrammes.[1] Cases have since been reported by Dr. H. F. Hansell and others.

Pausier recommends the introduction of medicinal agents into the eye by means of electricity, in cases where the iris is refractory to the use of drugs by ordinary application. Some 1 to 300 solution of eserine sulphate was instilled and a moist electrode placed on the eyelid through which a descending current of 2 milliampères was passed for forty minutes. At the end of this time the pupil had diminished in diameter from seven millimetres to two millimetres. Recurrence of the dilatation was again treated in the same manner and with the same result.

Pterygium has been successfully treated by Horace M. Starkey, of Chicago, by electrolysis. A fine platinum needle is introduced successively at two or three different points, across and under the enlarged vessels, connected with the positive pole, and a current of 3 milliampères passed for one minute, at each place. In interstitial keratitis mild faradization is of great value, according to de Schweinitz. Choroiditis, with floating bodies in the vitreous, is said by Robert le Mond to be successfully treated by direct application of mild faradic currents, once daily, with internal treatment by potassium iodide and corrosive chloride of mercury.

In **nose and throat diseases** the galvanocautery has been extensively used, and, in the opinion of some, greatly abused. The chief advantages over the knife and cold-wire snare are: the ease and convenience of the apparatus, its perfect asepsis, and the counter-irritant and stimulating effect to be obtained by minute points of cauterization. In skillful hands it warrants all the praise bestowed upon it, because its use is then limited to appropriate cases, while in unskillful hands it is indiscriminately employed, and sloughing and necrosis being caused by injudicious application. The source of power is now almost universally the storage cell, although the cautery battery is quite sufficient for all ordinary purposes; when the time of actual use is very brief, polarization does not have time to occur.

Nasal hypertrophies of mucous membrane are readily reduced by a touch of the galvanocautery. The platinum knife or probe should be inserted in a universal handle, bearing a spring switch, so that the current does not pass until the instrument is in place and can be instantly discontinued. If the instrument adheres, it should not be abruptly withdrawn, or it will

[1] *American Journal of Ophthalmology*, April, 1891, p. 127.

tear off a portion of mucous membrane and cause bleeding and an open wound. On the contrary, if the instrument is permitted to remain for a moment or two the natural secretions will be restored and it will easily drop out. In applying the cautery to posterior hypertrophies the rhinoscopic mirror should always govern the application, so that the operator can see just what he is doing.

In **granular pharyngitis** of singers and public speakers, accompanied by thickening in bands and bunches of enlarged follicles, excellent results follow the galvanocautery. Enlarged papillæ at the base of the tongue can be reduced by cautery-punctures, or removed without pain or hæmorrhage by the wide platinum snare.

As the rule, the wire should be heated to a cherry-red heat, and in nasal work it is often of advantage to use a shield, such as an ordinary metal aural or nasal speculum, or Shurley's ivory-blade speculum. It is a powerful hæmostatic and resolvent; and, when used as a destructive agent, its action is perfectly under control, and is limited to the area operated upon.

The galvanocautery has also been advocated as an application to the throat in **diphtheria**; but, while we are in possession of such antiseptics as hydrogen dioxide and chlorine and such solvents of false membrane as papain and lime, it is not likely that this plan will receive much favor. In **chronic enlargement of the tonsils** the use of the galvanocautery is often productive of decided diminution in bulk.

In keratitis fascicularis and ulcerations of the cornea galvanocauterization gives good results; and Darier[1] reports excellent effects in the treatment of two cases of **purulent ophthalmia.** Antiseptic douches with instillations of iodoform followed its cauterization.

Chronic Diseases of the Middle Ear.—Dr. Baxter has reported ten cases in which the use of the constant current was followed by improvement. The patient is placed with the head inclined and the external auditory canal filled with warm water. An aural electrode, or small wire insulated to within two millimetres of its point, is introduced into the canal and the sponge electrode is held in the patient's hand. From 5 to 10 milliampères of current are passed through the parts. The duration of an application is from three to six minutes. After the operation the patient is kept quiet for a time, in order to avoid the occurrence of vertigo.

Direct Electrization of the Stomach.—Owing to the inconvenience of the use of the stomach-tube, Kussmaul's stomach-electrode, introduced in 1877, was never a practical instrument for local or direct electrization of this organ. Dr. Einhorn[2] has constructed a novel form of electrode, on the principle of the stomach-bucket, and gives it the name of the "deglutable stomach-electrode." It consists of a hard-rubber capsule (about one and one-quarter inches in length) perforated with numerous openings, this cage serving to protect the metal knob within from direct contact. The connecting wire runs through a fine, flexible-rubber tube. The capsule is readily swallowed and tolerated by the patient, and contact is secured, as in Bardet's electrode, by water in the stomach. The faradic current has been generally employed, and in all cases the degree of acidity of the stomach has been markedly increased. The author makes a preliminary report, which goes to show that most decided results have been obtained in cases of dilata-

[1] *Journal American Medical Association*, Nov. 29, 1890.
[2] *Medical Record*, May 19, 1891.

tion and in grave cases of chronic gastric catarrh. Two cases of pure gastralgia showed an amelioration after use of the constant current. He concludes that faradization is most useful in dilatation and atonic conditions of the cardiac and pyloric orifices, and also in chronic glandular gastritis. Gastralgia of nervous origin or dependent upon ulcer receives more benefit from galvanism. The latter form of electricity has an excellent influence upon cardiac affections dependent upon gastralgia. The majority of cases of hyperacidity were improved, but required the administration of alkalies in the usual way. Dr. Charles G. Stockton, of Buffalo, N. Y., devised an ingenious electrode for direct electrization of the stomach in 1887. He reported very good results from its employment in cases of weakened or absent motility, gastric dilatation, catarrh, atrophy, etc. Dr. Boardman Reed, of Philadelphia, has found the ordinary faradic current, applied by means of the gastric electrode, decidedly beneficial in all cases of muscular atony or atonic dilatation. He advises slow interruptions with a weak current. In the condition of hyperchlorhydria he employs the high-tension coil, with five-minute *séances*, every second day, with good results.

Electricity in Intestinal Occlusion.—Where intestinal occlusion is due to transient intestinal paralysis through defective innervation, Semmola has pointed out that the constant current has a truly marvelous effect. He reports a case of diarrhœa, followed by acute constipation and colicky attacks, with obstinate vomiting and retention of urine. The positive electrode, olive-tipped, was inserted into the rectum as far as the sigmoid flexure; the negative pole, moistened with salt water, was moved about over the abdomen in various directions, especially along the colon. A current of 10 milliampères was used. Each application lasted about ten minutes, and was used three times a day. At the end of the third application the retention of urine ceased, the paroxysms were less severe, and the patient had visibly improved, but it was not until the ninth application, at the end of the third day, that the bowels were moved. The treatment continued two days longer, and the patient recovered.[1] In other cases of a similar nature even more rapid relief has been obtained by faradism, an insulated sound with free metallic end being inserted into the rectum and a moistened conductor applied to the wall of the abdomen.

"Electric Injections."—Under this name a method of using the constant current in cases of fæcal accumulation and intestinal paralysis has been described. The rectum is filled with salt-water in order to avoid the cauterant effect of a direct application to the mucous membrane. A metallic conductor connected with the positive pole is inclosed in an elastic sound and communicates the electricity to the water. The circuit is closed by placing a large negative electrode upon the abdomen. MM. Boudet and Larat have utilized this with benefit in a considerable number of cases. The author has also employed this method for several years.

Effects of the Galvanic Currents upon the Vitality of Disease-germs.—From various experiments by Cohn and Mendelsohn and others it has been ascertained that the vitality of bacteria may be destroyed by the passage of a current of electricity. Blackwood states that galvanism readily destroyed all varieties of germs, from 25 to 175 milliampères being required. Strong currents, such as from 10 to 35 ampères, not only killed the microbes, but

[1] Communication to Section of Medicine, British Medical Association, *British Medical Journal*, Feb. 20, 1892.

caused them to disappear entirely. Quantity, or ampèrage, is the main essential, for low quantity under strong voltage was ineffectual, while high ampèrage under comparatively low pressure was efficient always. Blackwood states[1] that he has obtained satisfactory results in actual practice in a number of diseases, such as scabies, lichen, favus, etc. In typhoid fever, dysentery, phthisis, diphtheria, intermittents, and sporadic cholera he reports good results from the application of galvanism as above indicated. He suggests this field to other experimenters as a promising one for further investigation. According to reported experiments by Apostoli and Laguerrière,[2] the action of the constant galvanic current upon cultures is in direct relation to the intensity of the current estimated in milliampères. A current of 300 milliampères and above, applied constantly for five minutes, kills charbon bacteria, while lower degrees of intensity of current merely attenuate the culture and render it less virulent. The positive pole alone produces this effect; the interpolar action and negative pole are indifferent. The general conclusion is that the continuous current in ordinary medical dose (50 to 300 milliampères) has no action *sui generis* upon microbe cultures in an homogeneous medium, and that its unique positive polar action should be referred to the liberation of acids and of oxygen.

Gonorrhœa offers a field for the use of the antiseptic effects of galvanism; but, unfortunately, the urethra is too sensitive in the male sex to permit the use of the high currents required; yet, in women, good results have been reported by Prochownik,[3] who treated ten cases of acute gonorrhœa with very rapid recovery.

The **electrical induction balance** is an ingeniously-constructed apparatus which will indicate the presence of a bullet or other metallic body when buried in the tissues. Several varieties have been constructed, but they are essentially the same, and depend upon the principle of better conduction of the galvanic current, and hence greater induction in a secondary coil, when the metallic object is included in the field or interpolar region. Dr. Kummer[4] recorded a case where a needle having become buried in the knee, its precise location was detected by an ordinary galvanometer, and also by a freshly-magnetized needle. Dr. Addinell Hewson[5] claimed that in a similar way he had been enabled to detect, by means of a small pocket compass, the presence of a fragment of an exploded shell imbedded in the muscles of the back. Unless the projectile were of iron or steel this experiment would not succeed with such simple instruments. The electrical induction balance and the electrical probe, however, will detect the presence of any metallic substance capable of conducting the electric current. Dr. A. B. Kirkpatrick[6] reports a case of gunshot wound in which the electrical probe was used with excellent results.

The electrical probe of de Wilde consists of two insulated wires contained in a flexible sheath, the ends being brought out at the extremity of the instrument. As soon as the wires touch a metallic object the circuit is

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[1] W. R. D. Blackwood, M.D., "Has Electricity any Action as a Germicide?" *Medical Bulletin*, Feb., 1892.

[2] *La Tribune Médicale*; *American Lancet*, Dec., 1890.

[3] *Centralblatt für Gynäkologie*, and *Pacific Record of Medicine and Surgery*, Nov., 1891.

[4] *Revue Médicale de la Suisse Romande*, Oct., 1890.

[5] Proceedings American Medical Association. Surgical Section. Newport Meeting.

[6] Proceedings Philadelphia County Medical Society, Oct. 14, 1891.

complete, and a small electrical bell, or "buzzer," indicates the fact. This instrument requires actual contact with the foreign body in order to produce the signal.

Electric Illumination in Medicine and Surgery.—Czermak in 1858 first called attention to illumination of the larynx by transmitted sunlight, and subsequently this method of illumination was greatly advanced and improved by Voltolini, by whom the electric light has been utilized for this purpose. Dr. W. Freudenthal devised an instrument containing an Edison lamp, which is applied closely to the larynx externally, while the laryngoscopical mirror is used in the usual way.[1] The instrument is made by Reynders & Co., New York. It appears to have special value for illuminating the subglottic region of the trachea.

Gastrodiaphany.—The attempt to transilluminate the stomach-walls was successfully accomplished by Einhorn. The instrument consists of an ordinary stomach-tube with a small Edison incandescent lamp inserted in its end, the conducting wires passing through the lumen of the tube. The value of this method depends for success upon the translucency of the abdominal walls, the absence of food in the stomach, and the emptiness of the bowels. The stomach must be thoroughly washed out and half a litre of water left remaining in the organ. The light is introduced, the patient being in the erect position. The operation must be conducted in a dark room. An absolute diagnosis cannot be made solely upon the use of the light, for often the colon and the small gut will transmit the illumination, and the result is misleading. The so-called red zone is very apt to be an indefinite luminous abdominal area.

The use of electricity in the production of hot-air baths, with incandescent lamps or electrically-heated coils of wire, has been found effective in treatment of chronic rheumatism and synovitis. In the sections on **Light** and **Heat** also will be found an account of the application of the arc light in phototherapy.

Diagnosis by X-rays.—Much attention has been attracted to the discovery, by Professor Roentgen, of Wurzburg, that opaque bodies can be penetrated by certain rays which are thrown out from the cathodal extremity of a Crookes tube, and that, by means of the ordinary photographic negative, shadows of opaque objects can be made to form pictures called by Cattell **sciagraphs.** Thus, when the human hand is examined, while exposed to these rays, the bones and articulations are clearly shown, and the presence of any foreign body, like a piece of glass or metal, is also revealed by its shadow. In this way bullets have been located in the tissues of living persons and photographs obtained, as an aid to operation and for permanent record. Mr. Edison has devised a fluorescent screen or apparatus for making such shadows visible without the aid of photography, and this instrument is now used in diagnosis, its application being at present more surgical than medical, although it is possible at times to detect gall-stones and foreign bodies in the bronchi, intestines, stone in the kidney, etc., in this way.

X-radiation has not accomplished as much in the department of laryngology as in other branches of medicine. It has, however, proved of great service to the laryngologist in the detection and accurate localization of foreign bodies in the upper portion of the digestive and breathing tracts;

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[1] *Medicinische Monatsschrift*, New York, Nov., 1889.

in determining the ossification in the laryngeal and tracheal cartilages,—a subject which has never been accurately determined before the advent of the x-rays; in the diagnosis of intrathoracic growths. The x-ray is likely to prove of distinct value in the early diagnosis of tubercular processes in the lungs.

Cases of foreign bodies in the trachea, abscess of lung following pneumonia, and solidified mediastinal gland, which gave rise to laryngeal symptoms have been diagnosticated by x-rays.

Dr. Morley Currie, of Toronto, has devised a method of making x-ray observations on hollow organs. He incloses a metal chain within the stomach-tube, which is then swallowed. By means of the x-rays and fluorescent screen the chain and the point of the tube can be followed and the lower border of the stomach accurately marked. This method may be applied to examination of the œsophagus, colon, rectum, urethra, bladder, vagina, uterus, and nose. Excellent photographs of the pelvis have been obtained with the fœtal head in various positions, and also photographs of vesical calculi and other foreign bodies.[1]

The therapeutic use of the rays has opened a new field in the treatment of various diseases, especially of the skin. Stenbeck, of Stockholm, describes a case of rodent ulcer in the tip of the nose of a woman, aged 67, treated by the Roentgen rays. The rays were applied for ten minutes daily at a distance of 10 centimetres. Reaction occurred after four sittings, and on the tenth pus appeared. After thirty-five sittings the ulcer was more healthy, and the epidermis began to grow in from the edges. After a short interval the sittings were increased to fifteen minutes, and a second reaction took place, followed by improvement. The epidermis grew over the ulcer, the edge flattened down, and in a month a smooth cicatrix was left, differing little from the facial epidermis, and surrounded by a slightly-raised border.

Dr. C. Thurstan Holland,[2] of Liverpool, England, reports the history of a case of eczema treated by x-rays. He explains their action as rather that of a stimulant of the tissues throughout the diseased area, enabling them to bring about recovery. Sycosis and favus are now to be added to the list of those affections in which these rays have given evidence of being beneficial. At a meeting of the Imperio-Royal Society of Physicians of Vienna, Austria, on June 2, 1899, Dr. L. Freund[3] presented three patients who had been cured "in from seven to thirteen exposures."

The use of the x-rays has at various times been productive of serious lesions of the skin, frequently the result of using a strong current at short range. The cutaneous phenomena observed vary greatly. An evanescent hyperæmia or erythema may be induced, and this is the most usual experience. At other times a dermatitis is produced, with much redness, swelling, vesicles, and bullæ, according to its degree, followed by excoriations. Or the process may be a deeper one leading to severe ulcerations and necrosis of the parts. Those who employ the x-rays frequently are liable to a dermatitis of the hands, associated with a change in the nails, the latter at times remaining permanently deformed.

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[1] *Dominion Medical Monthly*, July, 1898.
[2] *British Medical Journal*, vol. i, 1899, p. 1024.
[3] *Gazette Hebdomadaire de Médecine et de Chirurgie*, vol. xlvi, p. 575.

KINESITHERAPY; MECHANOTHERAPY; MASSOTHERAPEUTICS. MASSAGE AND REST-CURE.

History.—Kinesitherapy (κινησις, motion), or the treatment of disease by mechanical movements, is a well-established therapeutical resource. The high esteem in which gymnastics was held by the ancients for maintaining health and vigor led inevitably to the employment of modified, and especially passive, exercises in the treatment of appropriate diseases. Herodicus became so famous for his application of gymnastics to the improvement of health that Plato is said to have accused him of doing an ill service to the State by keeping alive people who ought to die, because, being valetudinarians, they caused more expense than they were worth to the community. In many places in the writings of Hippocrates we encounter expressions of his high opinion of the value of systematic and scientifically-directed massage. For instance, "It should be kept in mind that exercise strengthens and inactivity wastes." "Friction can relax, brace, incarnate, attenuate: hard braces, soft relaxes, much attenuates, and moderate thickens." The physician ought to be acquainted with many things, and, among others, with friction." These extracts are from the Sydenham Society's translation of the genuine works of Hippocrates; in Littré's translation the last sentence is more appropriately rendered, "The physician should possess experience in many subjects, and, among others, of massage."

The term massage (μασσειν, to knead or rub) is applied to the employment of pressure, strain, and other peculiar manipulations of the soft tissues of patients with the view of bringing about physiological and therapeutical effects. Known and practiced by the Chinese from the earliest period, by the ancient Persians, and later by the Greeks and Romans, its use, in one form or other, is almost universal at the present day, not only among civilized nations, but also among the aboriginal inhabitants of Africa and the South Sea Islands. Among the natives of Tongo and the Hawaiian Islands, for instance, a crude, though elaborate, system of shampooing is practiced, which is essentially a form of massage. During the middle ages the nations of Europe lost appreciation of this important handmaid of therapeutics, which was permitted to sink into oblivion by the medical institutions. However, it continued to be practiced by the laity, who often associated it with superstitious forms and observances, which brought it into still further scientific disrepute. It is to the French that we are indebted for the rediscovery and rehabilitation in medicine of this valuable therapeutic agent. Toward the latter part of the eighteenth century, Tissot (1780) and Meibom (1795) laid the medical world under obligation by their writings; the subject, however, attracted very little notice, until at a comparatively recent period Mezger, of Amsterdam, and his pupils Berghman and Helleday (1873) gave it a scientific foundation. The enthusiasm of a Swede, Peter Henry Ling, was necessary to popularize mechanotherapeutics, and in this he was so successful, particularly in his native country, as to be regarded, by many, as the creator of the modern movement cure. His leading physiological idea was that the nourishment and development of the muscles depended upon their use and amount of active movements they performed. The peculiar merit of Ling, according to Schreiber (who has given us an excellent

"Manual of Treatment by Massage and Methodical Muscle Exercise"[1]), lies in the fact that "he re-established the gymnastics of the ancients on a scientific basis, and, using the then known results of skilled German gymnasts, penetrated still deeper into the writings of ancient nations, and became one of the first to elaborate a complete system on an anatomical and physiological basis."

Technique of Massotherapeutics and Mechanotherapy.—The scientific, mechanical treatment of diseases presupposes some acquaintance on the part of the operator with regional anatomy and with the teachings of human physiology. It is true that in the hands of uncultured persons, who practice massage in an empirical manner, excellent results have been obtained, but this is due to the fact that ignorant people are often shrewd observers and are not modest in proclaiming their successes, while their failures are kept in the background. The so-called art of bone-setting, by which stiffened joints are restored to motion by systematic mechanical treatment, as practiced in this way, often is successful, and such cases are widely published; whereas, if the treatment was a failure, the result would not be sufficiently rare or interesting to be noticed.

In acquiring the art of massage it is of great advantage to have a skilled instructor to teach the various manipulations and their applications, and at the present time such experienced practitioners are to be found in many of our large cities. It is a manual art, however, and cannot be acquired either from written instructions or demonstrations, but by actual experience. This being admitted, we may agree with Schreiber that "the necessary knowledge and skill can very well be mastered without an instructor, if, with each manipulation, the final end, namely, the physiological effect, be kept strictly in view," provided that this be confirmed and established by sufficient personal knowledge of physiological, pathological, and therapeutical processes.

In his "Art of Massage" (translated, with notes, by Benjamin Lee, under the title of "Tracts on Massage") Reibmayr has very much simplified the nomenclature and the multitudinous procedures of Ling and the French writers particularly. He distinguishes the following principal methods of application:—

1. Introductory massage. **2. Massage proper.**

The divisions of massage are those of Mezger and his pupils, Berghman and Helleday, and are now generally adopted by scientific writers and practitioners:—

1. Stroking.
2. Friction.
3. Kneading.
4. Percussion.

1. Stroking is done with the whole palm, with the radial border of the hand, or with the thumb or ends of the fingers. The pressure may be as light as possible, and vary gradually from this to as much weight as can be borne, the operating hand being reinforced by pressure made upon it with the other, or the weight of the upper part of the body may be called into play to give sufficient force to the stroke. The direction is nearly always

[1] Translated, with the author's permission, by Walter Mendelson, M.D., of New York. Philadelphia: Lea Bros. & Co., 1887.

venous (centripetal, or toward the heart), but in rare cases it may be arterial (centrifugal, away from the heart).

2. Friction consists in more or less forcible, circular rubbing of a surface, with the palm of the hand usually, or with the fingers or final phalanx of the thumb. During the manipulation the remaining fingers of the hand, or, it may be, both hands, clasp the limb which is under treatment, making it a point of support. It is advisable to begin at the border of the pathologically-altered tissues, and work out the exudate into the surrounding healthy tissue in all directions, always concluding, however, with centripetal strokings.

3. Kneading.—This is what is meant by "massage," which, however, as an English word, is now used, in a comprehensive sense, to include all the manipulations employed in manual mechanotherapy, and is applied to such treatment, even though kneading proper be not included in the prescription. The restricted application of this term is to the method of picking up or grasping a certain portion of muscle or other tissue with the fingers of one hand and subjecting it to pressure between them, or upon a hard substance, such as a surface of bone. Dr. Douglas Graham, of Boston, who is especially skilled in massage, recommends that, in kneading, "each group of muscles should be systematically worked upon, and, for this purpose, one hand should be placed opposite the other; or, when the circumference of the limb is not great, one hand may be placed in advance of the other, the fingers of one hand partly reaching on to the territory of the other, so that two groups of muscles may be manipulated at the same time, with grasping, circulatory, spiral manipulations, one hand contracting as the other relaxes, the greatest extension of the tissues being upward and laterally, and, on the trunk, forearms, and legs, away from the median line. . . . It is well, first, to go over a surface gently and superficially before doing the manipulation more thoroughly and in detail." For instance, to take up a limb of considerable size, such as the leg, he finds three divisions of surface necessary: the posterior and lateral aspects will form one; the stretching of the perineal muscles from those of the anterior tibial region will make another; and for the third a rolling of the tissues will be made away from the crest of the tibia. "In large muscular masses we seize them, in successive portions, with both hands, and squeeze in all directions, as one would squeeze water out of a sponge," says Reibmayr. At the moment of making pressure a certain amount of longitudinal traction may be practiced, which adds to the value of the manipulation. Another, but much less effective, form of kneading consists in rolling the limb between the palms of the hands. The movements here are very rapid and pressure is less important, the principal effect being produced by the frequently-recurring stretching and forcible separation of the individual muscles, fasciæ, and nerves. Dr. Benjamin Lee judiciously sums up the characteristic features of this method in the following words: "Kneading is the procedure by means of which, above all others, we act upon the circulation of the deeper-seated tissues and profoundly modify the processes of absorption, assimilation, and destruction; in short, of tissue-metamorphosis,—in other words, of life. Hence, our aim should be, to as great an extent as possible, to avoid allowing any motion between the hand and the surface of the skin,—that is to say, friction or stroking,—and to compel the integuments following the motion of the hands and fingers to describe the desired movements over the underlying tissues.

We thus not only act upon the circulation of the blood in the muscular and visceral capillaries, but accomplish the very desirable objects of increasing the elasticity of the skin, opening the areolar lymph-spaces, sundering pathological adhesions between the inferior layer of the skin and the tissues beneath, and stimulating the flow of the areolar fluid. Just to the extent that we allow rubbing do we lose the essential virtues of kneading."

Vibration is a form of massage, the alternate pressure and relaxation being made with great rapidity. It is generally performed by means of a mechanical contrivance, by which any portion of the body or limbs may be thrown into vibrations at a rate of several hundred per minute.

Vapor-massage.—By the use of compressed air fluids may be nebulized and driven with considerable force against the surface of the body. Ordinarily, the objects sought after are the removal of adherent mucus from the upper air-passages and the application of medicated solutions; but excessive force is injurious. An apparatus has been devised by which the pressure can be regulated and made intermittent and the spray given at any desired pressure, or to have a vibratory effect, producing results similar to manual massage. Vapor-massage has proved to be especially useful in affections of the nose, throat, middle ear, and bronchial tubes.

4. Percussion may be performed either with the border of the hand, the tips or knuckles of the fingers, the closed fist, or with some instrument constructed for the purpose. The shocks should be rapidly, but not forcibly, delivered,—usually from the wrist only. For this purpose various instruments have been invented, such as Bennett's percussion-hammer, Granville's percuteur, or electrical percusser; also, Klemm's or Ruebsam's muscle-beaters. The latter are useful for self-flagellation, but the hand remains the best instrument for accurately controlling the amount of force exerted. After massage has been performed **active and passive movements** of the neighboring joints are usually resorted to, especially in case of diseased joints and in chronic cases with stiffened articulations. In the north of Europe massage has been systematically combined with Swedish remedial gymnastics (so-called movement-cure) with great advantage. In this method various kinds of gymnastic exercises are resorted to, and peculiar forms of apparatus are provided to meet various requirements of treatment.

Electro-massage.—A massage electrode, in the form of a small roller, affords an excellent means of combining the effects of electricity and massage. It is usually connected with the faradic apparatus, but in cases of paralysis or of exudation it might be very advantageously used with galvanism. Owing to its powerful effects, this form should be applied personally by the physician, or, at least, it should be used in his presence and under his direction, in order that the rules already laid down for the administration of electricity shall be duly observed.

The Roman bath is the term used to denote the use of some unguent, such as cocoa-nut-oil, codliver-oil, or butter, in conjunction with massage.

Physiological Effects of Mechanotherapy.—As might be inferred from the above description of the methods of massage, its physiological effects are very obvious, though complex. They may be considered as mechanical, thermal, electrical, and vital, the latter term being applied to the force or forces which resist disease and oppose death. The mechanical effects are immediate and most important. Under the movements there is a stimulation of the exchange of cell-contents, an increased activity in the movement

of the areolar fluid, and noticeably in acceleration of the blood-currents and contents of both blood-vessels and lymph-channels. The glands behave in a similar manner, although they are unaffected by mild electric currents; "every mechanical impression, such as stroking or pressure, whether over healthy or inflamed glands, causes the escape of large quantities of contained lymph." Von Mosengeil injected a thick solution of finely-levigated, black India ink into various joints in rabbits. Some were treated by massage; others were let alone for control experiments. Upon subsequently killing the animals, "In the cavities of the joints which had been kneaded no trace of India ink was found, while in those which had not been so treated it was observed in considerable quantities, mixed with synovia. On examining the thighs, numerous and widely-scattered deposits of India ink were found in the areolar tissue in those limbs which had been manipulated. These were entirely wanting in the others. . . . Well-marked deposits of the coloring matter were discovered in the intermuscular connective tissue. The crural muscles were also stained black. The thighs of the unmanipulated limbs were not in the least colored, the muscles being of a clear red. The glands of the manipulated extremities which were situated above the joints were stained intensely black, and the lymphatics leading to them could be detected by the naked eye as two black cords. In the untreated limbs ink deposits in the lymphatic system were entirely wanting." Similar conclusions are drawn from the results of Jawadski's experiments upon dogs. It was found that massage made in the direction of the heart accelerated the absorption of liquid substance introduced beneath the skin, and that it considerably increased the effects of those substances. The rapidity of the absorption during the massage does not depend upon the quantity of the injected liquid. Absorption is, therefore, stimulated by massage, and this holds good in the synovial lining of joints as it does elsewhere, the process taking place principally through the lymphatic vessels. In the blood-vessels stroking and kneading caused increased rate of blood-movement; this being assisted in the veins, as also in the lymphatics, by the pressure of valves in the inner walls. Randolph and Dixon[1] found, upon examination of the fæces of persons receiving inunctions of codliver-oil with massage, that there was a notable increase of fat in the discharges, thus proving absorption of the oil in 80 per cent. of the cases.

The temperature of a limb, and very commonly of the whole body, is slightly increased by massage. Arrested motion and friction give rise to thermic effects in the body as in the physical laboratory. Owing to physiological causes, the whole of the heat thus developed in a body under massage treatment is not made manifest by the thermometer, but is probably transformed into other forms of energy, such as electricity or cell-force. Heat, electricity, chemical action, motion, and life-force are intimately connected, and experiment and observation prove that properly-directed massage elevates temperature and improves nutrition, partly mechanically and partly through increased cell-activity. The vulgar notion that the operator directly transfers electricity or so-called animal magnetism from his own body to that of the patient has no other basis than this. Although a certain class of operators make capital for themselves by pretending to confer health or magnetism, their claims are either due to ignorance or to a deliberate at-

[1] "Transactions of the College of Physicians" of Philadelphia.

tempt at deception. What passes from the operator to the patient is motion and, to a slight degree, heat. The operator feels the result of exercise of his muscles and becomes fatigued, not because he has parted with any mysterious force, but simply because massage is rather hard work.

Schreiber divides the physiological effects into two groups:—

1. Primary (purely mechanical) **effects**: *i.e.*, the removal of lymph, exudations, transudations, and extravasations; the destruction of exudations by pressure, the removal of vegetations by friction, and the solution and removal of adhesions.

2. Secondary effects, which act by increasing the circulation by stimulating the muscular and nervous systems, by setting up molecular changes, and producing consequent changes in sensation, and by effecting alterations in the process of general nutrition.

Pain in an inflamed area being caused by the pressure of some exudation upon sensory nerves, relief will be produced by removal of this pressure under the effects of mechanotherapy. **Analgesia** is, therefore, obtained by massage. Inasmuch as manipulation causes an onward flow of the contents of the lymphatics and blood-vessels, massage has an **antiphlogistic action.** This is further demonstrated in its power of causing resorption of inflammatory products. It may also be regarded as an **alterative** on account of its effects upon effused fluids and its power of restoring healthy action in diseased parts. It is likewise a local **stimulant** and **counter-irritant.**

Neuralgia, or pain unaccompanied by inflammation, is usually the result of some lowering of the general nutrition, or the effect of a poison such as malaria. It may or may not be associated with any local lesion which acts as an irritant. Massage is especially serviceable in the first class of cases, owing to the improvement of local and general nutrition; but any source of irritation—such as eye-strain, caries of teeth, indigestion, etc.—should receive attention and be corrected if possible. The secondary effects of massage are included under the general heads of stimulation of vasomotor nerves and arterioles, with, in consequence, increased absorption and nutrition, and muscular contraction with increase of heat. Mechanical stimulus bears a strong resemblance to electrical stimulus in its effects upon the human body. According to Schreiber, "Any source of energy conveyed to a nerve from without first expends itself in producing molecular change, and this is again converted into energy, manifesting itself through the various forms of innervation." Hence, it follows that, as far as its effects upon the nerve-tissue are considered, it may be regarded as identical with electricity, within certain limitations. The proper appreciation of this is of much importance in mechanotherapy and is of daily practical application, especially in the treatment of neuralgia. The normal functional activity of the nervous system, according to Heidenhain, Hallstein, Tigerstedt, and others, consists of a species of wave-motion. The communicated motion or stimulus is converted, in some unknown manner, into the form of motion peculiar to nerve-substance. How molecular change is transformed into nervous force is a physiological problem which has not yet been solved; but this hypothesis of Tigerstedt is at least plausible, that nervous energy itself is a form of wave-motion among molecules, and analogous, therefore, to light and heat. Douglas Graham sums up the action upon the nervous system in the following enthusiastic terms: "Upon the nervous system, as a whole, massage most generally exerts a peculiarly delightful, and at the same time pro-

foundly sedative and tonic, effect. While it is being done, and often for hours afterward, the subjects are in a blissful state of repose; they feel as if they were enjoying a long rest, or as if they had just returned from a refreshing vacation, and quite frequently it makes optimists of them for the time being. An aptitude for rest or work usually follows, though generally those who submit to this treatment feel gloriously indifferent, and needless apprehensions are dispelled. I have never known anyone to take cold or suffer from exercise in the open air after general massage when ordinary care was observed. . . . Through the medium of the central nervous system even local massage is radiated or reflected throughout the body, thus acting at the same time as a nervous and vascular revulsive, or physiological counter-irritant, if one may be allowed the expression. One of the best examples of this, perhaps, is the relief from headache from manipulation of the back and shoulders. It has long been known that stroking the limbs often induces sleep. . . . The transmitted and reflected influence of massage must evidently be as numerous as the distributions and connections of the sensitive nerves that are accessible to its impression. Briefly, it may be said to act on distant parts by sympathy, by reflex action, and, as a variety of the latter, by inhibition." "Furthermore, massage excites and awakens the **muscular sense** in an agreeable and beneficial manner, such as nothing else does, restoring idiomuscular contractility and extensibility; and we know that the state of our muscles indicates, and often determines, our feelings of health and vigor or of weariness and feebleness." Estrádère[1] sums up the effects of massage in similarly enthusiastic expressions of opinion. "I think that this happiness, this quietude, this respiration more free, these ideas so pleasing, are the result of the equilibrium which at this time reigns over all the functions. The nervous system, no longer requiring to exert herself against obstacles to respiration, to circulation, and to nutrition, enjoys a tranquillity almost equivalent to repose, and then this state of oblivion, *de la vie expectatif*, in some manner leaves the imagination to dwell upon the ideas of beatitude which come in multitudes to occupy the nervous centres, and these now have no need to concentrate a certain part of their activity to control the functions,—to subdue some and to stimulate others."

Massage is the handmaid of medicine, in a literal sense, since the absorption, diffusion, and assimilation of remedies is favored by general massage,—at the same time that the emunctories are stimulated and the excretion of effete material by all the channels of excretion is encouraged.

Therapeutic Applications.—At the present day no physician can be considered well equipped for his duties unless he is acquainted with at least the fundamental principles of massage, and understands how to apply them in practice. It is by no means necessary that he should himself be an expert in the art of massage,—although this would be a consummation devoutly to be wished for his patient's sake,—but he should know how to prescribe massage as intelligently as he prescribes medicine, and should know whether or not the work is properly done, so that his patient may receive the greatest amount of benefit. It is too often the case that massage is "tried" in a case, and left entirely to some amateur *masseur*, who lacks tact and experience, and, after one or two *séances*, it is abandoned, and massage is brought into

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[1] Douglas Graham, "Manual Therapeutics, A Treatise on Massage," Third Edition, J. B. Lippincott Co., Philadelphia, 1902, page 112.

discredit. The physician owes it to himself and to his patient to see that the treatment is properly administered, and carefully adjusted to the strength of the patient. Some cases are benefited by ten minutes of massage, but would be completely exhausted by the full hour, which is the usual standard of service rendered among the lower class of operators. The golden rule in massage is that the operations should be conducted in such a manner and for such a period of time as will afford the greatest benefit to the patient, without being followed by any sense of fatigue; but, on the contrary, as stated on the preceding page, he should feel rested and invigorated after each treatment.

Neurasthenia and Hysteria.—Massage occupies an important place in the so-called "rest-cure" of Dr. S. Weir Mitchell. It must be remembered that the subjects for this combined treatment of physical and mental quietude, diet, electricity, and massage are either broken-down, chronic invalids or hysterical subjects, whose energies apparently are in a state of hibernation, or, at all events, in an abnormal condition as regards their response to the requirements of the mind and the body. Such patients are too weak for bodily exertion, often paretic, certain groups of muscles being affected more than others; there may be, and often is, great emaciation, due to want of exercise, and frequent pains and aches, owing principally to deficient nourishment of nerves and defective innervation of organs. Cases which have been bedridden for years have been cured by Mitchell, Playfair, and others, by enforced rest, improved nutrition, and electromassage. The psychological factor in the Weir Mitchell treatment is certainly a valuable adjunct. He insists upon isolation of the patient, forbidding all visitors, especially members of the family, absolutely confining the patient to the company of the nurse and the doctor, during the period of treatment, and, in some cases, even interdicting all private correspondence. "**Rest,**" says the author of this treatment, "means with me a good deal more than merely saying, 'Go to bed, and stay there!' It means care that letters bring no worrying news; that they are brief, and of such kind as a nurse may read aloud. It means absence of all possible use of brain and body. It means neither reading nor writing, at least for a time, with the exception in cases where, as is rare, there is no asthenopia. If the nurse can read to the patient, and reading be borne without fatigue, let it be used, at first, for only a few minutes at a time. If this wearies, then let the nurse try to cull the bits of interesting news from the papers, and, as she glances over the columns, talk this to the patient in place of formally reading aloud. . . . If you are disposed to smile because I say let the nurse feed the patient, you will not if, lying supine, you make the experiment of using your own hands in the act of feeding. . . . I believe that I have done something to make rest fashionable among physicians as an essential to the treatment of spinal maladies, and, both in them and in the treatment of neurasthenia and hysteria, it is well that you clearly comprehend what it is that I mean by rest. Your trouble will be, always, that the patient will desire to lie on a sofa, or to make some such compromise, but in bad cases—and it is only of these I speak—all this is but mere trifling, and you had better, on the whole, make an error in the direction of a too absolute rest."[1] The fact is, that in many

[1] "Lectures on Diseases of the Nervous System, especially in Women," p. 227, Philadelphia, 1881.

of these patients there is a long history of domestic tyranny by the querulous and exacting invalid, and the first battle to be fought is to establish the authority of the physician. Unless he can secure an unconditional surrender, so as to be master of the situation and have his directions obeyed, both in letter and spirit, he had better retire from his charge of the case, and refuse to accept any responsibility as to the results of treatment, in order to protect his own reputation. After he has secured the co-operation of those in authority, he is in a position to dictate the plan of treatment. The rest-cure consists essentially in keeping the patient passive, in the recumbent posture, for a certain length of time,—generally about three months,—keeping up nutrition by frequent feeding and the daily application of electricity and massage. The moral influence of the association with the trained nurse is of great advantage to the patient, as is also the knowledge that the term of treatment depends altogether upon the rate of improvement. In many cases this knowledge and the irksomeness of unaccustomed restraint combine to awaken an ardent desire to get well, which has a very happy effect upon the results of the treatment.

In hysterical paralysis, whether monoplegic or paraplegic, or in **hemiparesis,** the treatment by rest and massage, as above indicated, is of the greatest service, although in the lighter cases it may not be necessary, these being the patients who are likely to be benefited by the static current. Weir Mitchell, in the work already quoted, warns against allowing a convalescent, hysterical, paralytic patient to overtax her strength, or the original difficulty may return in an aggravated form. As regards the dietetic treatment, this is not the place for its discussion, but it is proper to observe that many fat patients are really thin-blooded and anæmic, and the first step toward improvement is a decline in weight. Mitchell reports one case of a paraplegic woman, weighing one hundred and seventy pounds, who was put to bed and allowed a milk diet mixed with a little rice-water or barley-water, the milk being gradually reduced to less than a quart a day; when she showed signs of weakness beef-soup was added to the diet for a day or two. In one month, under this regimen, her weight was reduced some twenty-four pounds. Massage and induced currents, with a good diet, now turned the scale; she gained in color and in flesh, and at the end of another month she could walk without much trouble.

Dr. Benjamin Lee points out a possible abuse of the rest-cure, and considers that the treatment, in other hands than the author's, is capable of producing injury rather than benefit. He regards the movement-cure as the essential agent in the restoration of these nervous invalids, and the enforced rest, apart from its influence upon the *morale* as a means of subduing the perverse will of a spoiled child, simply as an accident of the massage and the acto-passive exercise necessary, to a certain extent, to reap the full benefit of the method, not necessarily remedial in itself, and, without the other means, as likely to do harm as good. **Overfeeding**—which is insisted upon—is only made possible by the mechanical treatment, and, in its effects, may really be undesirable and pernicious, by overloading the emunctories to a degree entirely beyond their capability to take care of assimilated material forced upon them in order to build up adipose tissue. It is possible that this fat may be deposited in abnormal situations, as in the liver or in the walls of the heart. He holds that, in these cases of impaired nutrition, hydrated blood, degenerated tissue, and depressed nerve-force, our object

should not be to overload the economy with carbon and lay on layer after layer of adipose tissue, but to create a demand in the tissues farthest from the centre for healthy blood, by breaking down and forcing out the dead-alive cells, with their accumulations of morbid deposit, and sending them to the emunctories to be excreted, and, as this demand begins to be felt, supplying it cautiously,—principally with nitrogenous elements,—and not in excess of the assimilating organs to manage it. It is evident that the results of the so-called rest-cure will not be equally good in the hands of all who attempt to carry it out, and, where it is practiced, the greatest attention should be given to all the details in each individual case.

Massage in General Medical Practice.—**Headache** due to hyperæmia is relieved by neck-massage,—stroking the tissues upon each side of the larynx and trachea downward, thus accelerating the venous current in the numerous superficial veins. Its operation is analogous to that of blood-letting upon the cerebral vessels; the stroking, therefore, should be gentle, especially at first, and not too frequently repeated, or it may cause syncope. Massage of the muscles of the back, also, often relieves headache. **In congestion of the brain or membranes,** whether active or passive, the intracranial circulation may be diminished in this way, preparatory to the employment of slower derivative agents, such as purgatives. **In sun-stroke** Reibmayr is so convinced of its good effects that he says it should always be instantly resorted to. **Hemicrania,** of the congestive form, may be relieved promptly in the same manner. In the anæmic form of **hemicrania,** or **migraine,** massage of the neck does no good; but firm stroking of the frontal and temporal regions, with the eyes closed, usually brings relief. As such patients are readily hypnotized by gentle stroking of the head, this method should be employed with circumspection, unless it is desired to produce hypnotic sleep. **Nervous headaches** and some neuralgias are benefited by stroking and friction. Norström, of Paris, finds neuralgias of muscular origin, which are accompanied by centres of induration in the muscles of the neck, and often by tenderness along the nucha. These he attributes to chronic inflammatory processes, and that the removal of their indurations by massage is invariably accompanied by complete cure of the neuralgia.

In **tabes dorsalis,** or locomotor ataxia, good results have been reported by Schreiber and others following the use of massage. The annoying symptoms of this disease are undoubtedly relieved by mechanotherapy and the progress of the morbid lesions possibly delayed; but it cannot be said as yet that the therapeutical problem in this interesting malady has been solved.

It is in **sciatica** especially that the most brilliant results have been reported from the movement-cure. In sciaticas of rheumatic origin strong stroking, alternating with percussion, along the course of the affected nerve is usually successful in producing a cure in a short time. If pathological changes in the course of the nerve have caused the sciatica, the success of the treatment will depend upon their discovery and their removal, either by local massage or by other means. When tumors, or pathological changes deep within the pelvis, have caused the pain, massage may fail and, in fact, may aggravate the suffering. In uncomplicated cases cure may be hastened by combining massage and electricity. Painful points, especially along the spine, are frequently met with, especially in women. As such points are in some cases the point of departure for hysterical or epileptiform convulsions, it is important to relieve or remove them early by local massage.

In various neuroses of occupation, professional neuroses, of which **writers' cramp** is a familiar illustration, massage is the only agent capable of affording permanent relief. The method of Wolf in treating writers' cramp has already been mentioned under "Electricity"; it is a combination of stroking and friction, with both the galvanic and faradic currents. In cramp of the calf of the leg the toes should be strongly adducted, so as to twist the muscle, while friction is applied with the palm of the hand.

Chorea is a disease which is rapidly controlled by massage and gymnastics, as pointed out by Blache and Bouvier.[1] The treatment is by light stroking of both upper and lower extremities and the chest, the patient being held by attendants. The muscular masses of the back, especially at the neck and along the spinal column, are also massaged. The treatment, lasting for about an hour, should be repeated daily for three or four days. "After each treatment the irregular muscular contractions become less violent, and the patient gives it to be understood that he feels more comfortable. Sleep, which had been completely interrupted during the continuance of the most violent contractions, is gradually re-established, and speech begins to return. For several subsequent days the light stroking and friction must be persisted in, and the *masseur* may then begin very regular rhythmical, passive movements." Following these, acto-passive movements are encouraged for the next eight or ten days, when the patient may be encouraged to try to walk alone. As soon as he is able to accomplish this, active gymnastic exercises of simple character are superadded. By systematic training and encouragement the control of the will over the muscles is gradually established, while at the same time there is an improvement in the chlorotic condition, the heart and arterial murmurs disappearing. This method of treatment, according to its originator, Dr. Blache, is not followed by relapses, and the patients apparently are permanently cured.

The therapeutical effects of **vibration** may be briefly alluded to in this place. The late Professor Charcot testified to its beneficial influence in **paralysis agitans.** The patient was seated in a specially-devised arm-chair, which, by a mechanism set in motion by means of electricity, was made to undergo rapid oscillatory movements. Dr. Gilles de la Tourette has applied a similar method to the head in **megrim, insomnia, neurasthenia, melancholia,** etc. His apparatus, which is made in two pieces, bears some resemblance to a helmet, and upon its top is placed a small electric motor. The motor produces a uniform vibration of 600 revolutions per minute.

In **rheumatic paralysis,** or peripheral paralysis of a motor nerve as a result of exposure to cold, and also in **lead paralysis,** massage is an invaluable adjunct to the electrical and other treatment, and a tendency to degeneration of the muscles and nerve may thus be overcome.

In **infantile spinal paralysis** and **club-foot due to paralysis,** massage, systematically practiced, improves nutrition of the parts and is often curative if early resorted to. Erb considers it of service as an adjunct to electrical and other forms of treatment. It is often impossible for parents to bring their children to be treated daily with electricity, and they can be taught by the physician to employ massage at home. In **central paralyses** the nutrition and circulation of the palsied parts can at least be improved by massage.

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[1] "Use of Gymnastics and Massage in Chorea," Dr. Blache, Paris, 1854.

Dr. Murrell reported a case of recovery from **chronic** myelitis, in a man, 35 years of age, as the result mainly of massage.

In **acute catarrhs** of the mucous membrane of the upper air-passages, **in coryza, tonsillitis, pharyngitis, angina, and laryngitis**, massage of the neck is highly serviceable. Weiss employed this method with remarkable success, in a child with spasmodic croup, a single sitting relieving the most urgent symptoms; the short, wheezy respiration, accompanied by the most painful tension of the respiratory muscles, soon became more free, easy, and deep; the aphonia gave place to a voice which, although still hoarse, was no longer mute, and the child became more tranquil and willingly underwent the massage, inasmuch that it brought him such manifest relief. **Bronchial catarrhs, asthma of the pure nervous type**, and even **angina pectoris** are benefited by stroking, friction, and percussion with the palm of the hand until the skin becomes intensely reddened. In eleven cases of dry and serofibrinous pleurisy, Polakow observed favorable results from massage of the chest, though in suppurative cases it is contra-indicated. During the treatment the serous effusion was rapidly absorbed.

In **torpid liver, semiparalyzed condition of the intestines**, and **constipation** abdominal massage is capable of accomplishing much toward overcoming the morbid state. As stated by Reibmayr,[1] we should bring it into use in all those affections in which we desire to regulate the peristaltic movements of the stomach and bowels; to exert a favorable influence on the circulation of the blood and of the lymph so closely dependent upon those movements, and hence, secondarily, on the secretion and excretion of the digestive juices; to expedite the absorption of exudations; and, finally, to dislodge obstructing fæcal masses in the intestinal tube by direct mechanical action. Massage may, therefore, be practiced in **acute** and **chronic gastric** and **intestinal catarrh, dyspepsia, cardialgia, dilatation of the stomach, intestinal obstruction (ileus), tympanites** not dependent upon inflammation of the peritoneum, **ascites**, and, finally, all the sequelæ of peritoneal inflammation,—such as firm peritoneal or extraperitoneal exudations, swellings, and adhesions,—always provided that the inflammatory process is completely at an end. All inflammatory affections of the peritoneum, malignant tumors, and deep ulcerations of the stomach or intestines contra-indicate its employment. "For **habitual constipation**, especially in persons of sedentary habits, abdominal massage, combined with pelvic gymnastics, constitutes the most desirable, sure, and efficient remedy that we possess," in the opinion of Benjamin Lee. Constant moderate pressure has an analogous action. Dr. Feilchenfeld has successfully made use of a cushion containing three or four pounds of shot included between layers of wadding. Thus an equable pressure is maintained. The cushions are held in position by tapes and, as a rule, an hour or an hour and a half of this application is sufficient to bring about a movement of the bowels.

In **hepatic congestion with jaundice**, local massage over the liver with general abdominal massage for fifteen minutes daily are used, combined with gymnastic exercises for pelvic muscles. Abdominal massage, both manual and mechanical, is a valuable aid in strengthening the abdominal and visceral muscles, and to replace viscera. In cases of gastroptosis, after replace-

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[1] "Tracts on Massage," No. 3. Translated, with notes, by Benjamin Lee, Philadelphia, 1887.

ments by means of carefully-executed manual Swedish movements, the stomach may be retained in place by the abdominal supporter, applied while the patient is in a reclining position. M. F. Cantru claims that abdominal massage has undoubtedly a diuretic action, and is especially useful in cardiac diseases.

Chlorosis and **anæmia**, as suggested by the late Sir Andrew Clarke, are often associated with, and dependent upon, constipation. Abdominal massage to overcome the latter condition, combined with general massage of the entire surface, will render most favorable results. In **local œdemas** and **congestions** stroking, friction, and passive movements are rapidly curative.

Rheumatic gout, or, more correctly, **chronic rheumatoid arthritis**, is, according to Dr. Graham, amenable to massage, provided that the treatment commence before the pathological changes in muscle, tendon, bone, and surrounding tissues are too far advanced. Frequent visits and arduous work are required, but in the end amply repay both physician and patient for the time and trouble expended. He obtained gradual improvement from the use of massage in five out of six cases of well-marked rheumatic gout; and, by keeping up the treatment, four patients regained tolerable use of the affected limbs, and in one recovery seemed to take place. Berghman and Helleday, Courfield, and Balfour have reported cases similar to those of Graham, where marked improvement resulted from the treatment. His method was deep manipulation, without friction or inunction; passive motion as far as pain would allow, and sometimes farther; and resistive motion as soon as it could be done. If pain lasts for several hours, and increases after subsequent efforts, the treatment must be modified or suspended. Kneading with one hand, so as to break up indurations or disperse effusions, while the other hand pushes along the circulation in the veins and lymphatics above the joint, will often lead to absorption of products not too firmly organized. Massage of the adjacent area acts as a physiological derivative, and improves nutrition. The inutility of any other form of treatment makes massage the only resource in this disease.

In **heart disease**, when valvular disease has resulted in insufficiency and the compensatory hypertrophy is commencing to fail, at a time when there is slight œdema, fullness of the venous system, symptoms of hyperæmia of the liver, etc., general massage affords marked relief. The œdema disappears, the circulation improves, and the digestive organs perform their duties in a more satisfactory manner under the influence of properly-applied massage. In **weak heart**, due to deficient innervation or to lowered tone in the muscular tissue, following certain fevers,—such as typhoid, influenza, diphtheria, etc.,—the daily performance of general massage, with passive exercises, will gradually restore vigor and tone to the debilitated organ. Gentle, systematic, and resisted movements form an important part of the Schott treatment of heart disease as practiced at Nauheim, Germany.

In **diseases of women**, massage, on account of its corroborant power, is a valuable emmenagogue. It diminishes the suffering attendant upon dysmenorrhœa, and may be instrumental in restoring such normal relations as will overcome sterility. In malpositions and flexions of the uterus, with or without prolapse, the application of pelvic massage after the plan of Thure Brandt, of Stockholm, has proved very successful. It consists in (1) raising the womb; (2) massage of the organ and its ligaments; (3) forced abduction and adduction of the knees; (4) percussion of the lumbar and sacral

vertebræ. This method favors absorption of exudations, cicatricial bands, adhesions, etc., and was indorsed by A. Reeves Jackson, of Chicago. With regard to the correction of womb troubles, Weir Mitchell offers the following rules in connection with the rest-cure: "In the case of married women I make, or cause to be made, a thorough examination, to begin with. If there be only congestive states and their consequences, I trust to the general treatment for cure. If there be marked displacements or excessive menstruation, I like to correct the one and have the uterus well searched for possible causes of the other. Should there be grave fissures of the neck of the womb or perineal rupture, I prefer to have them relieved at once. Misplaced ovaries cause, in my experience, a great deal of trouble, but both Professor Goodell and I have seen a number of cases in which this annoying complication righted itself spontaneously during treatment by rest."

Keyes, Thure Brandt, Eberman, and others have beneficially employed massage in affections of the prostate gland. The method is practiced by means of the index finger introduced into the rectum. The bladder having been previously emptied, pressure and friction are made upon the gland, pressure being made in a direction toward the pubis and bladder. These manipulations are thought to promote absorption of pathological products by the lymphatics and blood-vessels. The method is unsuitable to acute prostatitis, but may be advantageously employed in the declining stage. If suppuration occurs, massage is a serviceable procedure after the abscess has been opened. The method is of special value in chronic prostatitis associated with swelling, and in soft, uniform hypertrophies of the gland.

In **skin diseases** extended experience has only confirmed the favorable opinions expressed by the author in 1884, in papers which he read before the section of Dermatology and Syphilis of the Eighth International Medical Congress, at Copenhagen, and before the American Medical Association (1883), on "Mechanical Remedies in Skin Diseases," as to the practical value of massage in this special field. He regards it as one of the most helpful agents at his command. To consider a few of its applications, we may commence with seborrhœa capitis. Gentle massage is here of great service in restoring perfect capillary circulation, promoting absorption, and imparting a healthy tone to the tissues. It prevents falling out of the hair, and favors a healthy new growth by improving the nutrition of the hair-bulb. In **acne indurata** and in glandular swellings in the skin, massage opens the clogged absorbents, causing the lesions to disappear and rendering the skin soft and elastic. Many skin disorders are the result of disturbed digestive processes and constipation, and the application of massage to the abdomen, by kneading and percussion, is of excellent service in removing the cause of the unhealthy condition of the skin. Excess or deficiency of pigment may be remedied by massage, owing to its dispersing power and tendency toward restoring normal action. In **psoriasis** and **scrofuloderma**, general massage is used to increase nutrition of the skin and promote the formation of blood-corpuscles and consequent oxidation. In the **itching** of acute or chronic eczema massage is directly beneficial, and patients may be instructed to use it in place of scratching with the nails, which produces secondary lesions and aggravates the original condition. Many **trophic disorders** of the skin are influenced favorably by properly-administered movements.

Infiltration of the skin, accompanied by roughness and scaliness, is a condition in which ordinary methods fail, but which will yield to massage.

In simple cases of rough, thick, and leathery skin, where it is desired to enhance the beauty of its texture, its fairness, softness, and elasticity, there is no agent so powerful as massage. Frequent warm bathing, an occasional Turkish bath, and daily shower-baths are very valuable in stimulating the cutaneous circulation, and should be supplemented by friction and kneading. The well-recognized benefits of friction with a coarse towel are feeble imitations of the results of skilled massage, such as gave suppleness to the muscles and health and beauty to the skin of the ancient Greeks.

Massotherapy is the best means in our power for rendering old, infiltrated, exudative material amenable to the action of the absorbent vessels. In **elephantiasis arabum,** deep kneading has led to excellent results. In the intervals of the application the limb may be compressed by a bandage, preferably of rubber. Very decided diminution of bulk has followed this treatment. **Ecchymoses** of the face or other parts of the body, due to bruising and consequent effusion of blood under the skin, are very disfiguring for the time; they may be rapidly dispersed and absorbed by rotary friction, stroking, and gentle kneading. **Hæmatoma** of the auricle, frequently occurring in the insane, is believed to arise frequently from direct injury. At all events, it gives rise to considerable deformity, and should be treated with massage applied in the same manner. In **furuncle,** before suppuration has occurred, gentle friction—first of the neighboring vascular area and finally of the lesion—will relieve pain and promote resolution. The pain of **herpes zoster** is said to be decidedly lessened by well-directed local stroking over the affected nerve. In **hyperidrosis** and other disorders of the perspiratory glands, good results may often be noticed after general massage, and the consequent improvement of the general health. In **sycosis,** we have had excellent results from general massage combined with local measures. **Ecthyma** being an expression of faulty nutrition, massage similarly promises good results by improvement of the general condition. **Impetigo** is similarly caused and similarly benefited. In **lichen planus** and **lichen scrofulosus** massage is of service, and it is calculated to counteract the constitutional depression attendant upon **lichen ruber. Scrofulous** and **syphilitic lesions** of the skin, especially occurring in weak patients or those of feeble constitution, or debilitated by intemperance, sexual excess, insufficient food, poor clothing, and bad air are rapidly benefited by general massage and proper hygienic management. **Cicatrices** and **hypertrophied scars** may be softened and caused to disappear by persevering applications of friction and kneading, especially if codliver-oil be used locally, by inunction, at the same time.

Morbid growths of a benign character, hypertrophied tonsils, and chronically-enlarged glands may disappear under general and local massage; and inflammatory thickening and indurations are often removed in this manner.

In **chloral poisoning, alcoholic coma,** or **opium narcosis,** as suggested by Dr. Murrell, massage of the extremities is useful in maintaining the circulation until antidotes have time to act.

Synergists.—Hygienic measures of all kinds assist massage in bringing the body to its highest state of physiological perfection. Pure air and exercise are powerful adjuncts; bathing, especially sponge- and shower- baths, are too much neglected; affusion, or pouring, of either hot or cold water, or each in turn, is a decided stimulant to the nerves and vessels of the part treated; and, in fact, massage is greatly aided in producing the desired re-

sults by these and similar means. Proper clothing, both at night and during the day, will assist the treatment. During massage the clothing should be removed, or of such character as to permit the required manipulations. In the use of apparatus, as in the Swedish system of mechanotherapy, and, in fact, in the drill, either with or without appliances, a gymnastic suit of flannel, with a belt at the waist, is indispensable. Intelligent supervision should be given to the daily food of the patient, in order that the best results may be derived from the movement-cure. The diet should be plain, nutritious, and, unless in special cases where the contrary would be required, it should be sparing. The object to be kept in mind by the patient should not be the gratification of the palate, but the needs of the system. The advice to exercise not for strength, but for health, may be accompanied by the admonition not to eat for enjoyment of the pleasure of the table, but to keep the body well.

Electricity is closely allied to massage in its effects upon the muscular system, as it produces contraction and commotion in the body of the muscle by acting upon the muscular fibres and end-organs of the nerves. As previously indicated, a combination of these valuable agents is used by means of the roller electrode, using either faradism or galvanism. The hand of the manipulator may also be made to act as an electrode and communicate a current to the tissues operated upon. In delicate patients and children this is the best manner of administering electricity, as they are reassured by the knowledge that the current must pass through the body of the attendant before reaching them. In the rest-cure faradic electricity is employed to produce contractions of individual muscles, and, in effect, it serves as a means of making passive motion. The massage is performed either before or after the application of the electric current, but generally before.

Some drugs are of great value in assisting a course of massage. They would generally be classed as nerve-tonics and restoratives, but it is often necessary to regulate the action of the digestive organs and get them into a normal condition before getting the best results of the massage treatment. If digestion is feeble, it may be well to give tonics and carminatives for a time, until the improved nutrition enables the glands to secrete a better quality of gastric juice and other digestive fluids. Where the liver is performing its duties poorly, the administration of a good cathartic will hasten the effects of massage, and in cases of constipation the use of a large warm-water-and-soap enema, or the injection of a small quantity of glycerin into the rectum, will assist the manipulations in moving scybalous masses. At the same time, it is observed that cases of constipation which come for treatment by massage are generally those which have been through the list of purgatives; and pills and potions have lost their effect, owing to an atony of the bowel-wall or paresis of the nerves causing peristaltic movements. As already intimated on a previous page, feeding is to be regarded as of more importance than drugging, and a judicious regulation of the dietary will often make remedies superfluous, especially if abdominal massage be properly practiced, in many disorders of digestion.

Tonic remedies proper or nerve-tonics, of which strychnine may be taken as a representative, have been greatly abused in the treatment of neurasthenic patients, who require massage and good hygienic treatment. Drugs very poorly substitute gymnastic exercise and fresh air. If patients should have their exercises regularly prescribed for them, and obey the

directions of the experienced physician in regulating their periods of work and rest, the supposed necessity for tonics would often disappear entirely from the therapeutic problem. Owing to the great faith which patients have in the mysterious virtues of remedies and the power of habit, they do not feel satisfied unless they have a magistral prescription, and are taking the regulation "teaspoonful three times a day." It is, perhaps, a pardonable weakness, perhaps a shrewd and judicious procedure, to concede something to the prejudices of the patient and prescribe, if not a placebo exactly, at least a mild stomachic; something bitter,—but not too bitter,—that he may satisfy his sense of propriety with while he permits the massage and electricity to do their perfect work. The good results will be apt to be ascribed to the medicine, but as our object is to cure the disorder, this undue exaltation of one part of the treatment must be suffered and ascribed to its proper source: the ignorance of physiological processes on the part of the patient.

Contra-indications.—Many cases of confirmed invalidism have drifted into the habit of taking comparatively large doses of various narcotic remedies, with which they stupefy themselves, and thus pass their lives in a more or less intoxicated condition. It need scarcely be said that the use of drugs which lock up the secretions, benumb the nerves, and lessen motility of the muscles is entirely opposed to the objects for which massage is practiced, and that such drugs must be abandoned if improvement of health is expected under mechanotherapy. Fortunately, as Murrell has pointed out, massage aids in overcoming the opium and chloral habits, and, if the patient wishes to escape from the physical and intellectual degradation which their constant use entails, no better way can be devised than a course of treatment of this kind. For many reasons, it is preferable that such patients shall be taken away from their friends and customary surroundings and treated in an institution directly under the supervision of the skilled physician in charge. The treatment must be mental as well as physical, and the first step to be taken is to secure the co-operation of the patient, and make him sincerely and earnestly desire to throw off the evil habit and to be restored to a normal state. If this be not secured the result will not be permanent, even if massage and gymnastics are faithfully performed, because a relapse will be inevitable as soon as the opportunity of indulgence is again presented. It is evident, therefore, that, unless the patient pledge his honor to abstain in the future, massage will be only of temporary benefit and will be brought into undeserved disrepute.

While massage may relieve pain in carcinoma and other forms of malignant disease, it is considered inadvisable, since it favors the absorption of the cancer-cells and their introduction into the neighboring glands and systemic infection. In aneurism the suffering may be relieved by light friction, but kneading or pressure must be avoided. In ulcer of the stomach, massage should not be practiced. It is considered injudicious, in atheroma of the cerebral arteries and in softening or tumor of the brain, to perform general massage; but gentle massage of the neck may be permitted, in order to assist the return of blood from the brain.

In recent apoplexy, hemiplegia, or monoplegia, and effusions into the spinal cord, it is better, for the first week, to abstain from massage. Subsequently, light friction may be used, in order to maintain nutrition of the limb by urging onward the lymph and blood in their respective vessels. If local softening of the brain should occur (red softening), anything like

active or passive movements of the affected limbs should be avoided as completely as possible. In chronic myelitis, it is generally considered that massage is of little value, but Murrell reports a remarkable case, which has already been referred to, in which it produced almost a complete restoration of motion in the paralyzed limbs. In recent neuritis the use of massage is interdicted, as the rule, although a skillful operator will be enabled to afford relief from pain and diminution of hyperæmia by progressive massage.

How to Prescribe Massage.—The usual method of prescribing massotherapeutics is to personally interview the **masseur** or **masseuse** (male or female operator), and indicate verbally, and, perhaps, by demonstration, exactly the character and duration of the movements desired. This is the best way, because the physician can remain and see the operations performed, and have a demonstration of the manner in which his ideas are carried into practice. Where the physician has his own trained nurses, who fully understand his directions and can be trusted to carry them out, this inspection on the part of the physician may be dispensed with, as it involves considerable loss of time. For his notes of cases, it is also desirable that there should be some abbreviated form of indicating the exercises. In the German and Swedish works on mechanotherapy these directions are given in terms which, to the uninitiated, are entirely meaningless, especially in the system of Ling and his immediate followers. Instead of indulging in such an expression as this, for instance, "Left—rest—right—extended—gait—left—side—support—standing," it would greatly simplify the matter if a code of arbitrary signs were adopted, as in the transmission of messages by the Atlantic cable. For instance, in regard to massage, the nurse may be supplied with a card, on which may be printed the following:—

No. 1.—Massage.[1]

A. All over	30	minutes.
B. All over	45	"
C. All over	60	"
D. Head-massage	5	"
E. Over the chest	5	"
F. Over stomach and bowels	5	"
G. Over the throat	3	"
H. Over the spine	5	"

No. 2.—Fomentations, with Wet Compresses.

A. Hot on back of neck and head, with ice-cold compresses over nose	15	minutes.
B. Hot between shoulders, with ice-cold compresses over lungs	15	"
C. Hot between shoulders, with ice-cold compresses over lungs	20	"
D. Hot between shoulders, with ice-cold compresses over lungs	30	"
E. Hot behind stomach, with ice-cold compresses over bowels	20	"
F. Hot behind stomach, with ice-cold compresses over bowels	30	"
G. Hot on sacrum, with ice-cold compresses over bladder	20	"
H. Hot on sacrum, with ice-cold compresses over bladder	30	"

No. 3.—Fomentations, Alternating with Compresses.

A. Alternate hot and cold, four changes, to dorsal vertebra	15	minutes.
B. Alternate hot and cold, four changes, to dorsal vertebra	20	"
C. Alternate hot and cold, four changes, to dorsal vertebra	30	"
D. Alternate hot and cold, four changes, to lumbar vertebra	15	"

[1] Massage of the head is not included in A, B, or C; so that where this is desired in addition it should be designated by adding D to the prescription.

E. Alternate hot and cold, four changes, to lumbar vertebra..... 20 minutes.
F. Alternate hot and cold, four changes, to sacrum ..... 15 "
G. Alternate hot and cold, four changes, to sacrum ..... 20 "
H. Alternate hot and cold to cervical vertebra..... 15 "
I. Alternate hot and cold to cervical vertebra..... 20 "
J. Alternate hot and cold whole length of spine..... 10 "
K. Alternate hot and cold whole length of spine..... 15 "
L. Alternate hot and cold whole length of spine..... 20 "
M. Alternate hot and cold to painful part..... 15 "
N. Alternate hot and cold, six changes, to painful part ..... 30 "

No. 4.—Ten-Minute Fomentations.

A. Over stomach and liver ..... 140°, two applications.
B. Over spleen .....140°, " "
C. Over bowels ..... 140°, " "
D. Over bladder ..... 140°, " "
E. Over right lung ..... 140°, " "
F. Over left lung ..... 140°, " "
G. Over both lungs ..... 140°, " "
H. Over throat and bronchi ..... 140°, " "
I. Behind stomach ..... 140°, " "
J. Behind bowels ..... 140°, " "
K. Behind lungs ..... 140°, " "
L. Back of neck ..... 140°, " "
M. On sacrum ..... 140°, " "

No. 5.—Fifteen-Minute Fomentations.

A. Over stomach and liver ..... 140°, two applications.
B. Over spleen .....140°, " "
C. Over bowels ..... 140°, " "
D. Over bladder ..... 140°, " "
E. Over right lung ..... 140°, " "
F. Over left lung ..... 140°, " "
G. Over both lungs ..... 140°, " "
H. Over throat and bronchi ..... 140°, " "
I. Behind stomach ..... 140°, " "
J. Behind bowels ..... 140°, " "
K. Behind lungs ..... 140°, " "
L. Back of neck ..... 140°, " "
M. On sacrum ..... 140°, " "

No. 6.—Twenty-Minute Fomentations.

A. Over stomach and liver ..... 140°, two applications.
B. Over spleen .....140°, " "
C. Over bowels ..... 140°, " "
D. Over bladder ..... 140°, " "
E. Over right lung ..... 140°, " "
F. Over left lung ..... 140°, " "
G. Over both lungs ..... 140°, " "
H. Over throat and bronchi ..... 140°, " "
I. Behind stomach ..... 140°, " "
J. Behind bowels ..... 140°, " "
K. Behind lungs ..... 140°, " "
L. Back of neck ..... 140°, " "
M. On sacrum ..... 140°, " "

No. 7.—Thirty-Minute Fomentations.

A. Over stomach and liver ..... 140°, two applications.
B. Over spleen ..... 140°, " "
C. Over bowels ..... 140°, " "
D. Over bladder ..... 140°, " "

E. Over right lung	140°,	two applications.
F. Over left lung	140°,	" "
G. Over both lungs	140°,	" "
H. Over throat and bronchi	140°,	" "
I. Behind stomach	140°,	" "
J. Behind bowels	140°,	" "
K. Behind lungs	140°,	" "
L. Back of neck	140°,	" "
M. On sacrum	140°,	" "

The prescription-blank would be as follows:—

Prescription Card for Treatment of

*Name*_____

*Address*_____

*Prescribed by*_____ *M. D.*

	M.	T.	W.	T.	F.	S.
No.						
No.						
Followed by No.						
No.						
At same time No.						

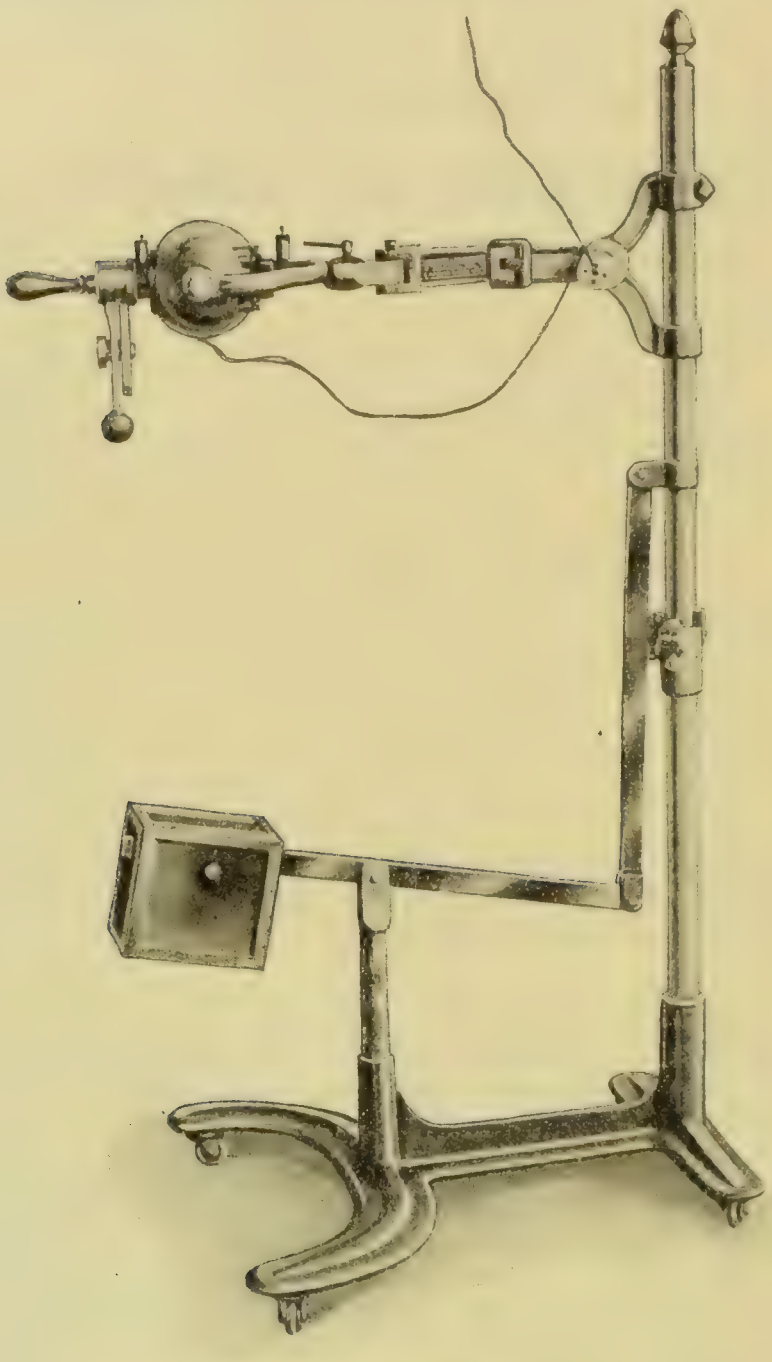
The masseur is requested to continue this treatment until otherwise directed, unless obvious change in the condition of the patient renders desirable an earlier consultation of the prescribing physician. The time of day may be indicated if desired.

The above is actually in use in this city, and its practical value demonstrated. The **masseur** or **masseuse** stands in the same relative position as the druggist to the physician, and simply carries out his directions as indicated by the prescription.

Vibrotherapy.—A form of percussion massage, in which the hand, or instrument, is kept in contact with the surface, while a mild percussion force is applied many times in the minute, causes a vibration in the deeper tissues, which is capable of producing physiologic and therapeutic results. J. Mortimer Granville, of London, was among the first to place this method upon a scientific basis and to use instruments for the purpose. Acute and sharp pain, he compared to a high note in music, which is produced by very rapid vibrations; while a dull, heavy pain resembles a low note, which is caused by slow vibrations. He therefore applied a slow rate of mechanical vibration in order to interrupt the rapid vibrations of acute pain; and conversely, applied very rapid vibrations for the relief of dull pain. By thus introducing discord into the rhythm of morbid vibrations, he claimed that relief or cure of neuralgia can be effected. He devised an instrument which he called a "percuteur," which was so constructed as to deliver a rapid succession of

blows of moderate force; both the strength and the rate of the percussion being subjected to regulation according to the case.

A number of instruments and elaborate apparatus have been devised for producing mechano-vibration. In some of these the power is obtained from compressed air; others work with a hydraulic motor; but the best forms



The Chattanooga Vibrator.

are run by the electric current, either alternating or continuous. A very satisfactory form of vibrator is shown in the accompanying illustration, which is made by the Vibrator Instrument Company, of Chattanooga, Tenn. Other forms in which the electric current is used, are the Waite apparatus, invented by Dr. Henry Waite, of the Waite & Bartlett Electric Manufacturing Company, of New York, and the Fraley vibrator, of Philadelphia. The special characteristic of the latter is that it has an attachment to, and is

applied by, the hand of the operator, so that the force of the application is subject to conscious control. Vibration can be used in connection with other forms of massage, or with the faradic or galvanic electricity, if desired.

Vibrotherapy is useful in a wide range of functional disorders. It not only stimulates the peripheral nerves, but also the vasomotor and trophic distribution. It acts upon the lymphatics and veins of the parts, so as to hasten absorption of effused products, or eliminate waste. It regulates the blood and nerve supply of glandular organs, like the liver, which it induces to increased physiologic activity. For hepatic disorders, the vibrations are directed to the right hypochondrium principally. In the treatment of insomnia, the vibrations are made from the sixth dorsal vertebra up the spine to the cervical region, for a short time; the patient then turns over upon his back, and vibrations are made to the intestine and abdominal organs, the latter with the view of attracting the blood from the head. For nervous headache, the vibrations should be directed along the spine, and be mild in character, so as to produce a quieting and soothing effect. By an adjustment of the apparatus, the stroke may be made stronger or weaker as desired, and at the rate of vibration preferred. This method is finding many applications at the present day, and is a valuable adjunct to other methods of treatment.

By the use of vibrotherapy, Granville claimed that pain could be relieved, the cerebro-spinal and sympathetic ganglia stimulated, torpid nerve-centres aroused to action, the reflex irritability of subordinate centres subdued, and these placed under the control of the higher centres. The vibrations may be propagated along the trunks and into the branches of the principal nerves from their centres of origin; or these may be called into action, reflexly, by the afferent nerves connected with those centres. Among its special applications is deficient motility of the digestive organs; in constipation, for instance, it never fails to produce a movement of the bowels. When properly regulated, it has a sedative action upon sensory nerves.

At the Fourteenth International Medical Congress, held at Madrid in 1905, Dr. J. Rivière called attention to a comprehensive plan of treatment which he calls "Physicotherapy." This is a curative method based upon the plan for increasing normal vital stimulants, by means of electricity, heat, light, baths, massage, and, in fact, all agents and apparatus intended to quicken physiologic processes. The object of the treatment is to improve cellular activity; and especially to aid the trophic and excretory functions, to regulate blood-supply, and overcome congestion and stasis. This is accomplished by apparatus for electrotherapy, vibrotherapy, radiotherapy, phototherapy, hydrotherapy, pneumotherapy, and other well-known means of kinesitherapy. In many cases, remarkably successful results have been obtained in functional and nutritive disorders, especially those of a chronic character, by a course of treatment such as just indicated, in which treatment by drugs is either subordinated, or entirely omitted.

PNEUMOTHERAPY AND PNEUMATIC DIFFERENTIATION.

Pneumotherapy, **atmiatria**, or pneumatic medicine, considers the administration of gases and remedies in a gaseous condition in the treatment of disease. The effects of changes in density and of the use of remedies under circumstances increasing or decreasing atmospheric pressure have re-

cently received so much attention that they will require separate discussion. The subject, therefore, will be divided into:—

1. The administration of remedies in a gaseous form: **Pneumotherapy.**

2. The administration of such remedies under altered conditions of atmospheric pressure, or in more or less condensed or rarefied form: **Pneumatic differentiation.**

A strict construction of the term "pneumotherapy" (πνεῦμα, air or πνευμον, lung, and θεραπεύω, to heal) would restrict it to the consideration of respiratory disorders, but it may also be employed as applied to treatment by the use of air or gases. An ancient medical sect, known as pneumatici, or pneumatic physicians, founded by Athenæus, held that an immaterial principle or element existed, upon which depended conditions of health, the excess or diminution of which caused disease. Previous to the revelations of the microscope and the advent of modern pathology and chemistry, this was about as far as hypothesis could be expected to carry us toward the discovery of the true nature of many diseases, but there is no good reason for the existence of such a medical theory in the twentieth century.

In proceeding to consider the therapeutic employment of certain gaseous substances, it is proper, in the first place, to devote a few words to a gaseous compound known as **atmospheric air,** its composition, and the effects upon the human system of alterations in the proportion of its constituents and the results of its contamination. Air is a universal and indispensable gaseous food. It is not a chemical compound, but simply a mixture of oxygen (about one-fifth) and of nitrogen (about four-fifths) with variable, but usually small, quantities of argon, helium, carbonic acid, ammonia, watery vapor, dust, etc. We cannot dwell here upon the physiological facts in connection with the effects of increase or decrease of carbonic acid or the presence of certain contaminations, especially the various forms of microbes and disease-germs. We may, however, in passing, point out, in a very general way, the difference in the rate of growth and development of children who have a plentiful supply of fresh, pure air as compared with those who lead a sedentary life in house or school. The subject of the ventilation of sick-rooms and apartments where many persons are crowded together, as in schools, factories, and work-shops, has been fully investigated of late years, and the breathing of foul air is now regarded as one of the principal causes of ill health and degeneration.

Conversely, in many patients the first therapeutic step to take is to secure for them a greater quantity of pure air than they have been accustomed to having. In modern treatises upon the practice of medicine great stress is usually laid upon the importance of the ventilation of living-rooms, and also of exercises in the open air. Drs. Trudeau and Sternberg found that the mortality from consumption, in rabbits inoculated with tubercle bacilli, was very much greater among animals confined in crowded, ill-ventilated hutches than among others which were allowed to run out and live in the open fields. Heated air has been employed in therapeutics not only in the form of the Turkish bath, but also used simply by inhalation. The effects here being simply those of elevation of temperature, they will be considered under the head of heat. The effects of differences of atmospheric pressure will be discussed in the present section, under the title of "Pneumatic Differentiation." The effects of breathing rarefied air are closely connected with those attending residences in elevated localities, where atmos-

pheric pressure is less than at ordinary levels. This deserves careful study, as upon it often depends the decision as to the proper sanatorium to send an invalid. It may be accepted as an axiom that patients suffering with advanced disease of the heart, lungs, or kidneys are injured by removal to a high altitude, as their systems do not readily become accustomed to the increased labor of breathing necessarily required by the rarefaction of the air. This, however, will be considered, more in detail, under the subject of "Climatology." Under this head, also, will be considered the effects of the presence in the air of moisture, and the differences between marine and mountain airs and places.

The presence of ozone in the air, and its consequences, will be hereafter referred to in discussing oxygen. When present, it is an important witness to the purity of the air and its freedom from organic contamination. Where great numbers of people live in crowded communities, ozone is never present. If the fact is borne in mind that the expired air from the lungs contains more or less excrementitious organic matter, it will be understood why crowd-poison, or rebreathed air, may be the cause of disease. Besides the increased quantity of carbonic-acid gas and the diminished proportion of oxygen, the expired air further varies from the standard of pure air, in that it has an excess of moisture, which contains odorous particles, and frequently bacilli and other forms of bacteria. Atmospheric air, however, except in special locations on the tops of mountains, may also contain many varieties of bacterial forms, and also organic material, in the form of dust, which may be of a very irritating character. The expectorations of tuberculous patients in the streets become dried, and tubercle bacilli have been shown by actual experiment to be present in street-dust, as well as in the confined air of the consumptive wards in a hospital. Manifestly, therefore, persons who, by heredity or acquired predisposition, are liable to suffer from phthisis, should live in a neighborhood where they can breathe pure air, as free as possible from all irritating matters, and especially pathogenic substances, and they should carefully avoid crowded vehicles or public halls. Consumptive nurses should never be allowed to contaminate the air that young children breathe by fondling and kissing them, infants being particularly liable to infection from this source. Operatives who work in overcrowded rooms, such as cigar-makers, cloak- and dress- makers, especially where there is much dust in the air, show the effect of privation of fresh air in their pallid faces and wasted frames, and they are also very subject to pulmonary affections from inhaled particles, which act as irritants. The first prescription for a cough, under such circumstances, would be fresh air, as pure as can be obtained. One of the principal beneficial effects of the movement-cure and massage is seen in the increased activity of the respiratory function which follows physical exercises; but increased respiration will not be of great benefit unless, at the same time, provision be made to supply a sufficient quantity of pure air. The report of the English Army Sanitary Commission, published in 1858, is conclusive in its proof that "the excessive mortality from consumption among soldiers, and in particular regiments, was due to overcrowding and insufficient ventilation. Previous to that inquiry the cubic space per soldier in the barracks of the Foot Guards only amounted to 331 cubic feet, and the phthisis mortality was as high as 13.8 per 1000. In the Horse Guards, on the other hand, with a space per man of 572 cubic feet, the mortality from phthisis did not exceed 7.3 per 1000. It was found that phthisis prevailed

at all stations, and in the most varied and healthy climates, the vitiated air in the barracks being the only condition common to all of them. In consequence of this excessive mortality, the Commissioners recommended that the cubic space allowed per man in barracks should be increased and the ventilation improved, with the result that, from the time their recommendations were acted upon, the number of phthisical cases occurring at all these stations has materially diminished. Similar evidence is afforded by the statistics of the Royal Navy, and notably as regards the civil population, in the report of the Health-of-Towns Commission, published in 1844. Indeed, it has been fully established that not only phthisis, but other lung affections, such as pneumonia and bronchitis, are generated, to a large extent, under like conditions, and the same may be said of such diseases as scrofula and others of an adynamic type."[1]

The announcement of the discovery of the tubercle bacillus by Koch, in 1882, has not invalidated the above observation. On the contrary, these observations are highly valuable, since they serve to explain the problem of susceptibility, or predisposition, by means of which some individuals acquire phthisis, while others, under similar circumstances of exposure, successfully resist the inroads of the bacilli. In fact, while the effects of constantly breathing vitiated air may not be at once manifested, in the way of causing pain or discomfort, other than frequent headaches or feelings of malaise, the consequences, in undermining the health, appear slowly, and are cumulative, but not less injurious. This is now universally recognized as among "the most potent and wide-spread of all the predisposing causes of disease" (Wilson). Following the dictates of sound judgment and experience, civilized nations have steadily improved the ventilation of dwellings and workrooms, and systematically remove from cities garbage and filth, which poison the air by undergoing fermentation and putrefaction, and give off poisonous vapors and disease-germs. Especially in hospitals has attention been paid, of late years, to this essential point, in order to secure an aseptic atmosphere for the sick. By the use of forced ventilation, the supply of pure air is maintained, which is now generally acknowledged to be an important element in the treatment of both sick and wounded.[2]

In the treatment of many chronic disorders, especially pulmonary affections, respiratory gymnastics, having for their object greater expansion of the chest and an increase in the tidal air, are of acknowledged value, and have been already referred to in the preceding section. In the treatment of asphyxia from coal-gas, carbon dioxide, or hydrogen sulphide, fresh air is absolutely necessary, as it is, also, in syncope and suffocation by drowning. As already intimated, many cases of cholera infantum are due to local poisoning of the air, and can be cured only by a change to a purer atmosphere. During the prevalence of yellow fever, cholera, small-pox, and other epidemic diseases it sometimes becomes necessary to remove a whole community to a more sanitary locality, the best disinfectant being pure air, and plenty of it.

Since the famous experiments of Dr. Priestley, there have been many

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[1] "Hand-book of Hygiene and Sanitary Science," George Wilson, London, 1877, Third edition, p. 65.

[2] For further elucidation of this subject, see recent work by John S. Billings, U.S.A., on "Hospital Construction."

attempts made to render air more curative by adding to it various substances, either in gaseous form or as a vapor, spray, or impalpable powder. The latter forms will be separately considered later, and in another part of the work will be given a number of useful formulæ for medicaments to be used by inhalation. Air may be made to carry, not only gaseous substances, but liquids and solids in minute subdivision. An excess of watery vapor is present in the Russian bath. It is also useful for inhalation by means of a croup-kettle or steam-atomizer, after operations for tracheotomy, and also in cases of catarrhal inflammation of the throat and bronchial mucous membrane. Various volatile substances may be added to the water, such as oil of eucalyptus-leaves, compound tincture of benzoin, iodine, and carbolic acid. Smoke from burning nitre-paper, diffused in the air, gives marked relief in asthma, or pyridin may be volatilized for the same purpose. Tar, cresylic acid, phenol, and other substances may also be administered in this way in pulmonary affections, and often with marked effect. Among the gaseous substances proper, chlorine has been used, largely diluted, as a bronchial stimulant, in narcotic coma or hydrocyanic-acid poisoning. Nitrogen is inert, and the results of its inhalation are due to deprivation of oxygen from the system. Hydrogen produces a peculiar squeaking voice, but otherwise is negative. The effects of oxygen are so important that they will be considered in a separate section. Modern surgical anæsthesia depends upon the mixture of a certain amount of vapor of chloroform, ether, ethyl bromide, or ethyl chloride with the respired air. This is considered in detail in the part devoted to drugs, under the individual headings of the articles in question (such as chloroform, ether, etc.), nitrogen monoxide, or laughing-gas, being considered under its own title.

Claude Bernard discovered that, under certain conditions, general anæsthesia could be produced for the time by directing a stream of carbon-dioxide gas directly into the throat and larynx; but this observation has not yet been utilized in practical medicine. Bergeon some years ago brought out a system of treatment for chronic pulmonary disease, the principal feature of which consisted in the injection into the large bowel of a mixture of carbon-dioxide and hydrogen-sulphide gases, with a view to their absorption into the circulation and excretion by the lungs. Some good results in the way of lessened expectoration, reduction of cough, and temporary improvement of the physical condition have been noted after the clinical trial of this method, but, as it is impossible for it to exert any antiseptic action upon the tubercle bacilli, and the bodily improvement is only transitory, the practice has fallen into disuse. If it had succeeded in accomplishing all that was claimed for it by its enthusiastic advocates, it would have afforded some support to the theory of Beddoes that there is an excess of oxygen in the tissues of consumptives, and that they are benefited by breathing air containing a considerable proportion of carbon dioxide.

Attempts have been made to destroy septic matter in the air, or, technically, to "sterilize" the air, in order to prevent infection of wounds during operations. The antiseptic method of Sir Joseph Lister, as first formulated, required a spray of carbolic-acid solution, so that the operation should be performed in an atmosphere charged with this antiseptic. It was found that this was not only inefficient and failed to fulfill the purpose, but it also was objectionable, and in some cases caused symptoms of carbolic-acid poisoning. Lister has since acknowledged his mistake, and the spray has disap-

peared from the operating theatre. Experience has shown that, if everything else coming in contact with the wound—the surgeon's hands, the instruments, and all the dressings, and the wound-surface itself—is rendered aseptic by proper solutions, under ordinary circumstances the air may be disregarded, except when contaminated by special poisons, like diphtheria or scarlatina. Dr. David Prince, of Illinois, however, has devised a very complete aseptic operating chamber, in which all the air is forced through antiseptic solutions before coming into the apartment. Where the air of a hospital is so contaminated as to require such a chamber, it would be safer to remove the patient, if possible, to more sanitary surroundings.

Oxygen.

Although not yet admitted to the United States Pharmacopœia, oxygen is a remedy of considerable therapeutic value, and, as an antidote to certain forms of poisoning, in some cases is indispensable to the recovery of the patient. It is administered in its purity or combined with other gases, such as nitrous oxide, nitrogen, or with atmospheric air. Oxygen is a colorless,[1] odorless, and tasteless gas, nearly sixteen times as heavy as hydrogen, a little heavier than atmospheric air (specific gravity, 1.1057), of which it constitutes 20.81 per cent. by volume, or 23 per cent. by weight, of dry air, in which it exists as a mixture with nitrogen, not chemically combined. Under certain conditions, it appears under the allotropic forms of **ozone** and **antozone,** in which it acts with peculiar energy. Under ordinary circumstances, oxygen is a non-condensable gas, but Pictet has succeeded by cold and pressure in making it assume the form of a liquid apparently containing solid particles. Water (H_2O) is a combination of oxygen with hydrogen (8 to 1). Hydrogen dioxide is also a liquid; clear, colorless, syrupy, and of a specific gravity of 1.453; it is a bleaching agent, and slightly caustic and somewhat irritating to mucous surfaces. It evolves oxygen at a temperature of 70 degrees or above, the ordinary commercial solution claiming to yield fifteen times its bulk of oxygen-gas. (See page 248.)

Preparation of Oxygen. — Among the several methods of preparing oxygen in the laboratory only those can be employed in medicine which are convenient and which yield a pure gas fit for inhalation. The most available method is by heating the solution of hydrogen dioxide, but where a considerable quantity is required this method would prove too expensive. The usual method is to heat potassium chlorate, so as to drive off some of its combined oxygen; and, in order to do this safely and to obtain the gas in steady volume, the potassium chlorate is intimately mixed with manganese dioxide, which does not enter into the reaction, but simply acts mechanically. The gas obtained in this way is passed through several wash-bottles containing dilute caustic alkali, and it is then collected in a receiver (gasometer) and kept over water. If the extemporaneous plan of making oxygen is employed, care should always be taken to see that the binoxide of manganese is pure and clean. If it contain coal-dust or charcoal as an adul-

[1] In the liquid form, Olszewski, a Polish chemist, finds that oxygen has a bright, sky-blue color. This is of interest not only as accounting for the blueness of the atmosphere, but also in point of view of the absorption-spectra of oxygen.

teration, a serious explosion may result. It is, therefore, recommended to heat gradually some of the mixture (4 of potash to 1 of manganese) in a glass test-tube, up to a red heat. If it should explode, the small quantity would do very little damage, especially when compared with that which would result from the explosion of several pounds of the same mixture. For each gallon of oxygen about 14 Gm. (or nearly $^1/_2$ ounce) of potassium chlorate will be required. Oxygen is now made on a large scale, commercially, directly from atmospheric air, and is sold at a very low rate, being delivered in steel cylinders, generally condensed so that a cylinder containing from one hundred to two hundred gallons is of a convenient size for handling. From such a holder or reservoir the gas is drawn into a rubber bag or a gasometer for ordinary office use or individual administration.

Physiological Effects.—When inhaled, pure, oxygen is capable of causing considerable irritation in the air-passages, and small animals immersed in it perish in a few days with highly-congested lungs. Ordinarily, when a moderate amount is inhaled in health, no irritation occurs. The gas, even when pure, is pleasantly respirable, and from four to eight gallons can be inhaled without any other obvious effect than a slight increase of activity of the circulation and some nervous exhilaration. Slight giddiness may be experienced for a few moments, but vertigo and headache are absent. In addition to the quickening of the pulse, there is evidence in the lips and finger-nails of increased oxygenation of the blood, and cicatrizing wounds, with granulation-tissue, have been observed by Demarquay to become more ruddy. The expiration of carbon dioxide is increased, and, according to some observers, is doubled in amount. Uric acid is lessened in quantity, according to Kollman, owing, probably, to the fact that a greater quantity is oxidized in the system. The digestion and appetite improve, and there are evidences of increased assimilation and resulting enhancement of physical strength.

Therapeutic Applications.—As has probably been inferred from the preceding paragraph, the chief application of oxygen is to conditions of asphyxia and dyspnœa from any cause. Thus, in poisoning by coal-gas, sewer-gas, hydrogen sulphide, carbonic oxide or dioxide, oxygen inhalations, promptly used, are followed by immediate good effects. In dyspnœa attending pneumonia, morbid growths in the larynx, or other grave disturbances of respiration, oxygen is of great service. In various chronic conditions the systematic administration of oxygen is often of value in improving assimilation and building up the system.

Thus, in anæmia and chlorosis, in chronic ulcers, and in strumous affections oxygen inhalations are practiced in one, two, or three daily sittings, using from 1 to 4 gallons at a time, either pure or mixed with atmospheric air or other gas, such as nitrogen monoxide. When a stream of oxygen-gas is directed upon a granulating or gangrenous surface it is said that healing is accelerated. When there is some impediment to the respiratory function, as in stenosis of the larynx, croup, diphtheria, emphysema, asthma, heart disease, œdema, or marked congestion of the lungs, the dyspnœa is greatly relieved by oxygen inhalations. The cyanosis of pneumonia is overcome by its means. In chronic pulmonary affections with reduced breathing capacity, we are now in a position to pass the same quantity of oxygen into the blood as is normally required, and thus put the patient on a more favorable footing for his ultimate recovery. As an illustration of its value, the

following remarkable case of pneumonia successfully treated by its aid is worthy of study. It was reported in the *Boston Medical and Surgical Journal* (No. 21, 1890): "The patient was a lady, aged 37, of neurotic tendencies, who suffered at first with ordinary lobar pneumonia at the base of the right lung. The general symptoms were very strongly marked, and, after the first few days of ordinary treatment, the disease spread to the upper part of the same lung, and alarming and excessive dyspnœa set in rather rapidly. Energetic stimulation and counter-irritation appeared to relieve the condition to some extent, but it recurred and showed itself less amenable to treatment. Inhalations of oxygen were given, the gas being simply conducted to the patient's mouth, after having been passed through a wash-bottle and diluted with 10 per cent. of nitrous oxide. Very decided relief was given for a short time, but again and again the dyspnœa returned, each time being staved off by the inhalation. At last it became necessary to keep up constant inhalation. The supply of gas began to fail, and before a fresh store could be obtained the patient was moribund. The gas was then given by artificial respiration, and the patient rallied once more. Constant inhalation was then kept up for one hundred and six hours without intermission, and at the end of that time the breathing was easy and natural, and complete recovery followed without further incident. The temperature fell during the long-continued inhalation, the average amount of gas being two hundred gallons in each twenty-four hours." Dr. Blodgett states that the effect of the gas was "almost as pronounced and evident as is that of a ligature in hæmorrhage." Dr. Lauder Brunton and Dr. Prickett report a case of pneumonia[1] where the patient was unconscious, livid, and almost moribund; but, after the inhalation of oxygen and the hypodermic injection of strychnine, he recovered his consciousness and his normal color, and expressed himself as feeling comfortable and well. Twenty-four hours afterward, however, breathing again became embarrassed, and, notwithstanding a somewhat freer use of oxygen, he died in a few hours. Dr. Skerritt, in the same journal (February 6th), says: "I have never seen such an extraordinary effect upon cyanosis produced by any other means, and, for the future, in any case of acute respiratory affection threatening to prove fatal, I shall not consider that everything practicable has been done unless a fair trial has been given to oxygen."

Another writer suggests that, even where cases are manifestly *in articulo mortis*, they may be temporarily improved so as to sign or execute legal papers by its aid. On the other hand, cases have been reported where inhalation was begun and the patient promptly died.[2] It is probable that the addition of 10 per cent. of nitrous oxide, by Dr. Blodgett, to the oxygen, contributed materially to the successful result. The question of details of administration will be again referred to shortly. In the dyspnœa of heart disease, the so-called cardiac asthma, it has been shown that the condition of the heart-muscle and the aorta is often an active or predisposing cause. The change in the aorta may be small and those in the heart considerable, or just the reverse. The aorta is more or less the seat of atheroma. The change in the heart is often that of chronic myocarditis; the coronary arteries are also found to be diseased.

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[1] *British Medical Journal*, Jan. 23, 1891.

[2] Colton, *Brooklyn Medical Journal*, Aug., 1891, p. 528.

In the diagnosis, according to Dr. Heitler,[1] if the organic lesion be overlooked, and a good prognosis given, it may be falsified by the patient dying suddenly from heart-failure. The most valuable sign is accentuation of the second aortic sound. For the dyspnœa and cyanosis of cardiac insufficiency, Dr. Heitler says the combined use of morphine and ether subcutaneously, with inhalations of oxygen, will cut the attacks short. In the opinion of Dr. Catlin,[2] oxygen is pre-eminently the remedy for profound shock, either from hæmorrhage or nervous drain, where the vitality is at too low an ebb to take up the intricate history of assimilation and repair. He reports a case of profuse hæmorrhage at the sixth month of pregnancy, followed by miscarriage. The prostration was absolute, with shock and constant vomiting. Continuous oxygen inhalations (mixed with air?) was administered, and the patient immediately improved and made a good recovery. He also reports cases of prostration during typhoid fever, in which oxygen was inhaled with marked benefit.

Professor Tarnier has used oxygen inhalations in the treatment of very young children, and Bonnaire[3] has employed it in the newborn, especially the premature infants who are placed in a "*couveuse*," or incubator. He gives the following suggestions:—

"1. Whenever there is insufficient pulmonary hæmatosis, either from obstruction of the respiratory passages or from weak action of the mechanical apparatus of respiration, or from want of excitation of the respiratory nerve-centre, oxygen administration is indicated. Apparent death in the newborn is, therefore, the first indication, though this does not exclude efforts at artificial respiration; besides, oxygen is not always available as soon as required. But if the first dangers of asphyxia have been overcome, and respiration is still ineffectual, or pulmonary disease imminent, with general asthenia, oxygen will be found a valuable recourse.

"2. Oxygen is also indicated for disorders in the interstitial circulation, of which sclerema in premature infants is one of the most common manifestations.

"3. Changes in the blood, of infectious origin like that which takes place in the hæmaturic bronze disease, of which mention was made." (It was used in several infants suffering with bronzing and hæmaturia: a disease resembling pernicious anæmia. It was administered for two hours daily, and was successful in several cases in the first stage of the disease.)

"4. Conditions in which there is decided depression of the temperature. Athrepsia, in its acute and chronic forms, is the type of such conditions."

Neumann[4] speaks in high terms of the administration of air containing a high percentage of oxygen, under increased pressure, for which he employs an apparatus of his own devising. By using a mixture with air, he avoids the irritation caused by the pure gas, and the slightly-increased pressure facilitates absorption. The pulse, at first quickened, is ultimately slowed. No unpleasant head symptoms arise. There is no palpitation; in fact, the heart's action is regulated. Sleep is often induced, even in men. In many patients the night's rest has been improved, the breathing rendered easier,

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[1] *Centralblatt für die Gesammte Therapie*, Oct., 1891.
[2] *Brooklyn Medical Journal*, Aug., 1891, p. 521.
[3] *Journal de Médecine*, June 28, 1891.
[4] *Therapeutische Monatshefte*, Oct., 1891.

and there has been induced a feeling of increased strength. In three cases of tuberculosis, treated at the same time with Koch's method, the fever disappeared in two and was lessened in the third. The action of iron, when given for chlorosis, may be increased by oxygen inhalation. Neumann has thus treated severe cases of anæmia, convalescence from pleurisy, phthisis, sepsis, and diabetes with good results. He thinks that it also may be of service in gout, as it diminishes the proportion of uric acid in the urine.

Dr. Francesco Valenzuela has published a paper, in *El Siglo Medico*, on new methods of administering oxygen, with especial reference to the treatment of senile pneumonia. He administers the gas by the rectum, and also by injection hypodermically. He reports that in every case of senile pneumonia, with dyspnœa, in which oxygen enemata were given, dyspnœa was decidedly and permanently relieved. The ease and rapidity with which the gas was absorbed by the intestine were remarkable; indeed, it seemed to be as readily taken up by the intestine as by the lungs, four injections, of 5 litres each, being absorbed in an hour. Thus, the intestinal mucous membrane may be regarded as a valuable adjunct to the lungs in the function of respiration. In employing oxygen subcutaneously Dr. Valenzuela believes it important to introduce the gas in a nascent state. The arm was selected for the injections, and the quantity of gas introduced varied from half a litre to a litre. Cellular emphysema was, of course, produced, and a sensation of heat was complained of, but both disappeared within a few hours. There was no calmative action or slowing of the respirations, but there was marked stimulation of the heart: a desirable result in the collapse that follows pneumonia and fevers of a typhoid character, and cerebral congestion and asphyxia. No mention is made of the temperature of the gas that was administered: a point which, according to Dr. B. W. Richardson, of London, is of great importance.

It has been stated that oxygen inhalations are of service in the vomiting of cholera as well as in the algid stage.

Dr. G. Thompson,[1] from a review of the therapeutic value of oxygen, arrives at the following conclusions: (1) in dyspepsia the gas controls the subjective symptoms; (2) it is effective in cyanosis, by diminishing the frequency of the respiration and relieving the subjective dyspnœa; (3) oxygen is of value in the partial inflammation of the lungs due to various causes; (4) it is especially useful in the dyspnœa of chronic Bright's disease, uræmia, pneumonia, capillary bronchitis, asthma, catarrhal bronchitis, congestion of the lung, and of the first period of pulmonary œdema.

In surgery the topical application of a stream of oxygen-gas to ulcers has been found to exercise a stimulating and curative effect. In surgical anæsthesia by ether, when there is evidence of insufficient circulation, oxygen is a valuable aid to respiration. If a mask is used the oxygen may be allowed to bubble through a wash-bottle containing the ether, until the color of the patient is restored. In cases of coal-gas poisoning and asphyxia, the oxygen inhalations are also indicated.

Apparatus and Technique of Administration.—Samuel S. Wallian attributes the failures observed from the use of oxygen to various causes, and to many conditions under which the gas may be devitalized (?) by the im-

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[1] *Norsk Magazin for Lægevidenskaben*, Christiania, p. 274; "Annual of the Universal Medical Sciences," 1891, vol. v, p. A-117.

perfect processes employed to evolve, store, and use it. He insists that the oxygen should be freshly prepared and washed before using. Except in special cases of narcotic poisoning, asphyxiation, syncope, and other serious emergencies, the gas should be well diluted. The undiluted gas may be given in quantities of 800 to 1000 cubic inches at a sitting, once or twice daily. It is more economical to dilute it with air, since a comparatively small portion only is utilized at each inspiration. If nitrogen monoxide be combined with it (oxygen, 2 parts; nitrogen monoxide, 1 part), as they are synergistic, better results are obtained. Dr. Wallian also insists that patients should be instructed or made to inhale the gas properly. The person being erect, and the chest thrown a little forward, the lungs are then filled to their utmost capacity, and the gas held as long as possible, then expired through the nasal chambers. The respiration should be deliberate, and not hurried. Better results can be obtained if patients are taught chest gymnastics, so as to develop the muscles of respiration and increase the capacity; imperfect habits of breathing, tight clothing, awkward position of the body, and sedentary occupations are to be avoided, as far as possible. Oxygen may also be administered internally, by charging water with it under pressure, and Wallian recommends the mixture of oxygen and nitrous oxide, as above, which are dissolved in the water under a pressure of one hundred to one hundred and fifty pounds to the square inch. Oxygen-water has already been used in the Paris hospitals by Dujardin-Beaumetz, with some good results, in dyspepsia, debility, and chronic pulmonary or digestive disorders. It has been highly extolled in the treatment of infectious diseases, like small-pox, scarlatina, diphtheria, etc., and in many forms of skin disease.

For inhalations, the gas is supplied ordinarily in iron or steel cylinders, containing forty and one hundred gallons, under pressure. Attached to the cylinder is a cloth-covered rubber bag, which serves as a reservoir and enables the quantity taken to be accurately measured. A bottle partly filled with water is also attached, so that the gas from the reservoir passes through it, and is then received into the bronchial passages in the form of moist oxygen. A small gasometer may be attached, for the purpose of administering the gas under pressure, or for use when it is desired to introduce it into the rectum. The gas may also be injected into the bowel by an ordinary Davidson syringe connected with the rubber bag containing oxygen. In order that absorption may be facilitated, it should be of the same temperature as the interior of the body, or a little higher than the surface temperature.

Ozone and its Medical Uses.

Attention has already been directed to an allotropic condition of oxygen which is known as ozone (from the Greek $o\zeta\eta$, a stench). It was so named by its discoverer, Schönbein, who announced that the sulphurous smell produced by a stroke of lightning was due to this substance, which is also known as "electrified oxygen." It is formed by the sparks from the static electrical machine, and also during the electrolysis of water and during the slow combustion of phosphorus in a moist atmosphere. Ozone was first obtained in appreciable quantity by von Siemens in 1854, who discovered that the noiseless electric discharge was much more productive of ozone than the intermittent discharge, and he constructed an apparatus for the production of ozone by means of tubes. Subsequently, this has been still

farther advanced by the labors of the well-known firm of Siemens & Halske, of Berlin, who furnish a comparatively cheap apparatus, by which an unlimited supply of ozone can be obtained.

Ozone is a colorless gas, possessing a characteristic odor resembling dilute chlorine. If the air contain only the one fifty-thousandth part of ozone this smell is distinctly discernible. It is one of the most powerful oxidizing agents known, attacking and destroying many organic fabrics, such as rubber, paper, etc. Ozone has been liquefied at a temperature of 105°, and under a pressure of 125 atmospheres. According to the investigations of Chappius, ozone in this state is of an intense-blue color. The relationship of ozone to oxygen is peculiar. In the formation of ozone three volumes of oxygen become condensed to form two volumes of ozone. In the presence of iodide of potassium and moisture one-third of the ozone is spent in liberating the iodine and the other two volumes escape as oxygen. Test-papers are made by making a solution of starch and iodide of potassium, in which bibulous paper is immersed and then dried and cut into slips of convenient size. When it is desired to test for ozone one of the slips is moistened; if ozone is present in the air it will liberate iodine, which, in turn, will act upon the starch, producing a blue color. Ozone is found at the sea-shore; in the forest, especially if of coniferous trees; at the summit of mountains and high towers. It is usually absent in crowded cities and where organic matter is undergoing slow oxidation. Clouds owe their formation largely to ozone, which is more hygroscopic than oxygen; but only the upper surface of clouds and mists which are exposed to the sun's rays contain ozone: it is not found in dark and thick mists. A great amount of ozone is formed in the mist rising from the cold ground, under a clear sky, on a calm autumn or winter day. As Schönbein demonstrated, atmospheric ozone is only generated in considerable quantity when oxygen, moisture, and sunbeams combine, as in the familiar illustration of the bleaching of linen upon the lawn from the effects of ozone. According to Scoutetten, under the influence of light the green parts of plants exhale both ozone and neutral oxygen, both of which are again taken up in part by the growing cells of the plants.

Physiological Effects.—Some interesting results in plant-life were obtained by Ringk, a striking improvement being soon manifested after treating withered and drooping house-plants by ozonized water. Owing to its powerful oxidizing effects, ozone is believed to play an important part in nutrition. The red blood-corpuscles have the power of converting oxygen into ozone, and it has been suggested that, since ozone has the power of rendering albuminous solutions uncoagulable by heat, it exercises a similar effect in the human body, and prevents coagulation in the blood-vessels during life. Protoplasm has the power of storing up ozone, which it subsequently uses as a source of energy. In many organs, such as the liver, spleen, and thyroid glands, ozone is found in considerable quantity; in the muscles only slightly. Owing to the superior affinities of nascent oxygen, ozone plays an important part in tissue-change.

In concentrated form ozone is irritating to the air-passages, and may cause inflammation, salivation, bloody expectoration, and death. Œdema of the lungs was noticed by Binz, who claimed that a comatose condition supervened before any noticeable irritation of the bronchial tubes occurred, and that guarded administration produced soporific effects. The effects of

an increase or diminution of atmospheric ozone upon the health of communities has not yet been positively determined. Professor Falb, having noticed a remarkable diminution of ozone in the air in the summer of 1889, was led to attribute the epidemic of influenza to this fact. The air-bacteria are either destroyed or rendered less active in the presence of ozone, and, where this is absent, infection is more apt to spread. Ozone is nature's antiseptic agent, and Dr. B. W. Richardson, in his "City of Health," suggested that there should be a building like a gas-house, in which ozone should be made and dispensed by pipes to every house.

Ozone in Medicine.—It is believed that one of the principal advantages gained by sending patients away from a crowded city, especially where infection is present, is that the air is pure and contains appreciable amounts of ozone in the country. When it is possible, children, especially, should have frequent opportunities of getting fresh air; and, therefore, the charities which, like the Fresh-Air Fund and Country Week, take city children out of town during the extreme heat of summer are of great value, both in curing and preventing sickness. By special apparatus, it is possible to charge distilled and sterilized water with ozone, or ozonized oxygen may be passed through oil until it is saturated. These ozone preparations have high value as disinfectants and deodorizers. Ozonized water is capable of producing beneficial results in diseases of deficient oxidation, as in anæmia, chlorosis, lithæmia, and may be very useful as a germicide in treating infectious dyspepsia. Dr. Henry S. Norris, of New York, after the use of ozonized water internally in the treatment of fifteen cases of phthisis, reports that the results were beneficial in many of the cases. The oily solution is claimed to have especial value in chronic skin diseases, by inunction; in the dermatomycoses, or parasitic diseases; and in cases of infiltration of the skin and glands.

Schmidt[1] has reported excellent results in two cases of epithelioma following parenchymatous injections of ozonized water, and considers that it may also be serviceable in sarcoma and in tuberculous tumors. In the treatment of diphtheria, Schmidt reports remarkable success from applications of ozone-water, and Ringk advises its internal administration. Dr. Schnee, of Carlsbad, claims that ozone-water is of the greatest benefit in true as well as in functional diabetes. In phthisis, ozonized oxygen (9 per cent.) gave good results, in the hands of Dr. A. Ransome.[2] The inhalations, which were taken three times a day (seven litres each sitting), were followed by notable improvement, chiefly by gain in weight. Iodoform in pills and cod-liver-oil were given, in conjunction with the oxygen, and much better results were obtained with the oxygen than previously. In cystitis, Dr. Duhrssen, of Berlin, obtained successful results following injections of ozone-water.

Ozonized air may be obtained by the apparatus of Labbé and Oudin, which consists of concentric tubes, three to four millimetres apart, the intervening space being traversed by the static electric current. To obtain a sufficient quantity of ozone, they take the interior tube, sealed and containing the rarefied air, which acts as a perfect conductor, and apply it to the surface of the dielectric, which is of glass. The other armature of this form of condenser is constituted by a metallic sheet applied to the internal

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[1] *Münchener medicinische Wochenschrift.*

[2] *Medical Recorder*, London, May, 1890.

face of the external tube, and it is between the metallic sheet and the surface of the internal tube that the current forms the ozone. The slightest elevation of temperature which is produced in the cylindrical space separating the two tubes is sufficient to produce a current of air, which ascends and bears along the ozone thus formed. Under the circumstances, the air does not contain more than eleven to twelve hundredths of a milligramme of ozone per litre, which the authors term the therapeutic dose. Experimentation having shown the perfect innocuousness of these inhalations, they were given to children suffering with cachexia and anæmia, and were not only well borne, but evidently curative, by increasing the oxyhæmoglobin until it reaches the normal figure. It was found, also, that tubercle bacilli were rendered less virulent, as a result of exposure of cultures to currents of ozonized air. Dr. Caillé, after an experience of five months, upon twenty-two cases, concludes that the daily inhalation of ozone increases the oxyhæmoglobin in the blood from 2 to 4 per cent. in a short time, that in pertussis these inhalations exert a distinctly curative influence upon the disease as regards duration and severity. Dr. W. J. Morton and Dr. Clarence C. Rice, of New York, have observed the local effect of ozone-gas upon eight different patients, all of whom suffered from various grades of atrophic rhinitis and dry pharynx. The method employed was to instruct the patient to take a deep inspiration and then hold the breath while the ozone-gas is allowed to pass into the nostrils through the tube. The current is passed as long as the patient can hold his breath. The immediate effect, though differing in degree according to the volume of gas employed and, probably, according to the sensitiveness of the nostrils, was a mild smarting of the nasal mucous membrane for several hours, together with increased secretion. The secretion, however, was more easily expelled, and at the end of twenty-four hours the head felt unusually clear and the mucous membrane more comfortable than before the application. The odor from the nostrils disappeared after the second application. These results are encouraging, but whether permanent moistening of the mucous membrane and decrease of secretions can be obtained by the use of ozone can only be confirmed after a longer trial. Dr. Rice has also made use of a preparation called "therapol," a combination of sweet oil and 8.75 per cent., by volume, of ozone, applying it locally on cotton by means of an applicator, in two cases of ozæna with the effect of deodorizing the nostrils.[1]

Nitrogen and Nitrogen Monoxide (Nitrous Oxide).

In the mixture of gases constituting the atmospheric air, nitrogen simply acts the part of a neutral body, or as a diluent for the oxygen. The effects of breathing superoxygenated air have already been considered. If we now turn to hypo-oxygenated air, or air containing increased quantities of nitrogen, we are brought in face with the phenomenon known as "asphyxiation." When pure nitrogen is breathed the effects upon animals is quite uniform. Dr. George Johnson, in a paper on the "Physiology of Asphyxia and on the Anæsthetic Action of Pure Nitrogen,"[2] found that the animals rapidly succumbed as a result of the arrest of the pulmonary circulation. The right cavities of the heart were found enormously distended and the left

[1] *New York Medical Journal*, Aug. 19, 1893, p. 198 seq.
[2] *The British Medical Journal*, Feb. 21, 1891.

were comparatively empty: a condition which is evident during the life of the animal, the change from the normal taking place progressively during the progress of the asphyxiation. In the last stage of asphyxia there is a continuous increase of pressure in the pulmonary artery, while the systemic arterial pressure is falling. The immediate cause of the arrest of the pulmonary circulation appears to be the contraction of the pulmonary arterioles. The phenomena which result from the inhalation of nitrous oxide as an anæsthetic, in the opinion of Dr. Johnson, are strictly analogous with those observed in the early stages of asphyxia. At his suggestion, nitrogen was employed at the dental hospital for extracting teeth in nine patients: "In every case the result was the production of complete anæsthesia, with general phenomena precisely similar to those observed during nitrous-oxide inhalation. The pulse was first full and throbbing, then feeble; in the advanced stage respiration was deep and rapid, with lividity of the surface, dilated pupils, and more or less jactitation of the limbs, the only difference, in the opinion of some of those present, being that the anæsthesia was less rapidly produced and somewhat less durable than that from nitrous oxide, though in each case the tooth was extracted without pain." Subsequent experiments with a mixture of 3 per cent. of oxygen gave the following results: "Five patients took the 3-per-cent. gas. Anæsthesia was complete in 75 seconds (maximum) and in 60 seconds (minimum), the average time required being 67.5 seconds. In each case the tooth was extracted without pain, the duration of anæsthesia being somewhat longer than with pure nitrogen. In each case there was lividity, dilatation of pupils, and more or less jactitation." With a mixture containing 5 per cent. of oxygen the average time for producing anæsthesia was increased to 87.5 seconds. In each of four cases there was complete anæsthesia. One patient had three molar teeth extracted. "Although she said she felt the last two, the sensation appeared to be that of a pull, and not of acute pain. In most of these four cases there was slight lividity before the removal of the face-piece. In only one case was there slight jactitation of the limbs; the other three patients were perfectly quiescent."

An interesting feature in Dr. Johnson's experiments upon animals was the effect of amyl nitrite in overcoming the contraction of the pulmonary arterioles, and thus permitting the right side of the heart to become empty, and the heart's action, previously almost suspended, was restored. By this means life was prolonged until death finally occurred from increasing venosity of the arterial blood. Inhalations of amyl nitrite may, then, be regarded as the remedy for asphyxia, and at least a partial antidote to nitrogen or nitrous oxide, especially when aided by artificial respiration.

The similarity of the anæsthesia produced by nitrogen monoxide to that occurring from asphyxia by any neutral gas, such as nitrogen, hydrogen, or carbon dioxide, was first pointed out by Elihu J. Thomson, in a communication to the *Philadelphia Medical Times*, in 1875. This theory of the action of nitrogen monoxide in producing anæsthesia denies any specific action, and ascribes the effects solely to the deprivation of oxygen. While this is possibly true of the complete anæsthesia, yet it must be evident that smaller quantities of nitrogen monoxide produce a sense of mental and physical exhilaration and increase the pulse and respiration, which is not due to diminution of oxygen, and does not occur with the other neutral gases above mentioned. It is this preliminary intoxication which has given it the popu-

lar name of "laughing-gas." It has already been suggested that the addition of nitrogen monoxide to pure oxygen is useful as a respiratory and cardiac stimulant, and its effects are preferable to those of oxygen alone; and this combination is also decidedly safer than pure oxygen, which is sometimes irritating.

In the *American Journal of the Medical Sciences* for August, 1891, appeared an article by Dr. William W. Van Arsdale, giving a report of his experience with a mixture of nitrogen monoxide and pure oxygen as an anæsthetic. His object was to obtain anæsthesia without causing asphyxia. From Paul Bert's experiments, it is known that the latter can be obviated by the mixture of as much oxygen as is contained in atmospheric air (20 per cent.); but, under ordinary circumstances, the tension of the nitrogen monoxide is so reduced by this combination that no anæsthesia is produced, and animals breathe it with impunity, just like atmospheric air. The problem of obtaining the atmospheric superpressure was solved by Paul Bert in his hermetically-sealed, glass operating-chamber,—like a diving-bell. In this cage the patient, surgeon, and assistants were admitted, and, by means of the air-pump, any desired density of the air was obtained. Under these circumstances it was found that the nitrogen monoxide and oxygen mixture produced anæsthesia without asphyxia. Dr. Van Arsdale sought to do away with the expensive chamber, and substituted a mask for the patient's face, which would admit of administration of the gas under pressure. He prefers a 10-per-cent. mixture of oxygen, administered by an ordinary bag, rubber tube, and an air-tight mask. The great difficulty in most cases was found to lie in the fact that patients would not breathe deeply, but this was overcome by applying pressure: by placing a board weighted to five pounds upon the reservoir-bag. His conclusions were, that many cases were unsuitable to this method, the failures being due to nervousness, idiosyncrasies, and possibly alcoholism. But ruling out these cases, he says: "In the majority of cases, however, in young, healthy individuals and in females, the anæsthetic mixture, when administered under pressure, was found to work well, and to be much superior to the pure nitrogen monoxide for surgical purposes. It induces a state resembling a quiet, deep sleep, in which the respiration is slow and regular, the pulse regular and full, and not much, if ever, increased in frequency. The blood-pressure is not increased, and insensibility to pain and unconsciousness go hand in hand.

"We have," he says, in conclusion, "in the 10-per-cent. mixture of oxygen and nitrogen monoxide, an anæsthetic which may be administered with perfect safety, and for a sufficiently long time to permit of the circumspect performance of most minor operations, but one which may be characterized as a weak anæsthetic. For, although it will plunge the average adult into a state resembling peaceful slumber, in which anæsthesia and unconsciousness are well marked, it cannot gain victory over states of great nervous excitement or dread, or certain habits or idiosyncrasies." In other words, this form of anæsthesia resembles ether, which sometimes fails to produce anæsthetic sleep, and recourse then is usually had to the more powerful chloroform, or to scopolamine-morphine narcosis.

Nitrogen monoxide has been used therapeutically in certain nervous affections. Dr. W. R. Birdsall[1] published the results of his experiments upon

[1] *New York Medical Journal*, March 7, 1891.

sixteen patients suffering with various neurotic complaints. In none of these did he observe any positively beneficial effect. He used 20-per-cent. diluted gas during a *séance* lasting ten to thirty minutes. The effects were transient, and he concludes that the uses of nitrogen monoxide for medical and surgical purposes must be restricted to its effects as an anæsthetic and as a placebo.

Nitrogen monoxide is usually obtained by heating ammonium nitrate, which decomposes at an elevated temperature and forms water and nitrogen monoxide ($NH_4, NO_3 = 2\ H_2O + N_2O$). The product is washed by passing through water, which soon becomes saturated with the gas. It is kept in a gasometer, or in retorts obtained from manufacturers of the gas, in which it is reduced to a liquid form by strong pressure. From these small cylinders the administrative bag is filled, as occasion requires, for use in brief surgical operations, such as pulling teeth, etc.

Oxygenated, aërated water is a proprietary article containing five atmospheres of nitrogen monoxide in water. It has but little odor, and is slightly sweetish to the taste. It has no special therapeutic effects.

The other gaseous elements are used in medicine only very exceptionally. **Hydrogen-gas** will produce asphyxia, like nitrogen monoxide, but its inflammability and liability to be contaminated with metals like arsenic and zinc make it dangerous. It has been brought to notice in the expedient of Dr. Senn, of Chicago, who injected it into the bowels, in order to detect any perforation, by the flame-test, but this has been found unsatisfactory, and has been abandoned.

Pneumatic Differentiation and Treatment by Inhalation.

In the preceding article reference was made to an apparatus for the administration of remedies under pressure. Pneumatic differentiation is the process by which the air surrounding the body and that entering the lungs are rendered of different pressures. It may be positive, negative, or alternate. The first is where the air entering the lungs is maintained, during both respiratory acts, at a greater pressure than that surrounding the body. Negative differentiation is the reverse of this. Alternate differentiation is where the other two forms are alternated successively, the air entering the lungs under greater pressure, and in expiration the pressure surrounding the body being greater.

An apparatus was invented by Dr. Williams, for the purpose of applying this method of treatment, and is known as the "Pneumatic Cabinet." The physics and physiological effects of pneumatic differentiations have been sufficiently discussed in a number of communications, which appeared some years ago, when the Williams Pneumatic Cabinet was first brought to the notice of the profession. In an article by Dr. Isaac H. Platt,[1] of Brooklyn, on the "Physics and Physiological Action of Pneumatic Differentiation," a very good *résumé* of the subject is presented. It is very evident that this apparatus, which increases the air-pressure within the lungs, and also enables us to diminish the tension of the external atmosphere and thus empty the air-cells more completely, will not only produce fuller respiration, but also will act as pulmonary gymnastics, through the greater activity of the bronchioles and air-cells. There is, in consequence, freer

[1] *New York Medical Journal*, Nov. 6 and 13, 1886.

expansion and the opening up of collapsed lobules, while the expectoration of exudative material and foreign substances will be assisted. The secondary effects upon the pulmonary circulation will also be of considerable importance in bringing a larger quantity of blood under the influence of the air, but the effect of this is not so great as would at first be expected, owing to the tendency to increase of residual air, and the production of qualitative or partial emphysema. Dr. Platt concludes, from a summary of the effects of pneumatic differentiation, that, "by means of the differential process in its three forms, we can increase or diminish the difficulty of expiration or of inspiration; we can increase or diminish the tidal air, the vital capacity, the stationary air, and the residual air. We can, to some extent, control the amount of blood in the lungs, and consequently control pulmonary congestion and hæmorrhage, and we can raise or lower arterial blood-pressure. It is hardly possible that such wide-spread phenomena can be induced without producing other and secondary results, through the influence of the nervous system and otherwise." Therapeutically, Dr. Platt concludes: "The result of my experience and study has been to convince me that a large share of the benefit derived from the use of the cabinet is due to reduction of congestion, and consequently of inflammation, in the diseased lung by the differential pressure, in very much the same way as a bandage will afford relief to an inflamed joint. In addition to this, undoubtedly, the increased expansion to which the lungs are subjected, and the passive exercise which they are afforded, will do much to modify their nutrition and increase their vitality."

The pneumatic cabinet has also been advocated as a means of conveying medicated vapors and gaseous medicaments deeper into the pulmonary structures than is possible by ordinary means. Although the enthusiastic advocates of this treatment speak in high terms of the results, it really has not been shown beyond question that such remedies are really introduced more deeply into the air-cells and bronchioles than under ordinary pressure, except in so far as air-cells which had collapsed or have been plugged up have expanded under the pulmonary gymnastics. The subject is worthy of more attention and study, but it is beyond the reach of the ordinary practitioner. In institutions for treating pulmonary affections and hospitals room may well be found for such a highly-specialized apparatus, and a limited field of usefulness determined for it.[1]

More attention has been given to the subject of the administration of air and other gaseous elements, under varying pressure, of late years, especially in Europe. In France, at Contrexéville, there is an aërotherapeutic institute. The pneumotherapeutic institute of Brussels is especially worthy of mention. It gives:—

1. Baths of compressed or rarefied air, with or without supersaturation with oxygen-gas.
2. Inhalations of compressed air with expiration into rarefied air.
3. Electrotherapy.
4. Acts as a depot for manufacture and sale of oxygen-gas.

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[1] Those interested in this subject may refer to the "Proceedings of the American Climatological Association" for 1886 for papers by Professor Loomis, of New York; Dr. Donaldson, of Baltimore; Dr. Williams, of New York, and Dr. Platt's paper, already referred to. *The Philadelphia Medical Times*, vol. xvi, p. 654, contains abstracts of these papers.

The effect of baths of compressed or rarefied air will be discussed farther on, when considering the physiological effect of climate. Reference can only be made here to the apparatus of Waldenburg, Solis-Cohen, and others, for the administration, by a sort of gasometer, of compressed or rarefied air, the effects of which resemble those already mentioned as resulting from the pneumatic cabinet. For further elucidation of the subject the reader is referred to Dr. Arthur Hill Hassall's work on "The Inhalation Treatment" (London, 1880) and other recent literature in this field of therapeutics.

Medicated Vapors — Atomization — Inhalation. — Volatile medicinal substances may be vaporized and the odor, smoke, or vapor inhaled; non-volatile substances may be dissolved in any convenient menstruum, such as water, liquid petrolatum, oil, glycerin, etc., and made to assume a condition of fine spray by means of an atomizer, of which there are several kinds. In the first form to be described the apparatus consists of a convenient-sized rubber bulb connected with an hermetically-sealed bottle or receiver containing the medicated solution, into which air is forced by compression of the bulb, thus displacing the liquid, which escapes through a tube with a capillary point, at the side of which a strong blast-air is forced, thus comminuting the drops into a fine spray. In another form the air is not forced into the bottle, but is directed across the extremity of the delivery-tube in such a manner as to produce a partial vacuum, which causes the liquid to rise into the tube and to escape in a fine cloud. In an improved form, the blast of air is supplied from a metallic receiver, into which it had previously been forced by an air-pump. A well-known form is the steam-atomizer, in which the steam from boiling water supplies the blast. In the several forms of steam-atomizers there is the advantage of the warm moisture, but the remedies should be in stronger solutions than for the hand-atomizer, or dry atomizer, because of the dilution by the steam. Solid substances may be finely powdered for insufflation and inhalation, although this scarcely comes within the limits of the present subject. Below may be found some formulæ for use with inhalers and atomizers.

Formulæ for Inhalation.—These remedies may be ordered to be simply dropped upon a handkerchief and held to the nose, or poured upon absorbent cotton, in a test-tube or special-shaped tube for inhalation, or contained in a a **respirateur** of wire gauze covering the nose and mouth. For infants or invalids the remedy, when volatile, may be dropped upon the patient's clothing or simply upon the pillow:—

℞ Spt. ammoniæ aromat. ..... q. s.

For inhalation in syncope, heart-failure, narcotic poisoning, etc., being careful that the vapor or gas is well diluted with air.

The following combination is much used in England:—

1. ℞ Phenol. liq.	4	Gm.	or 3j.
Carbonis ligni	15|5	Gm.	or ℥ss.
Iodi	4	Gm.	or 3j.

Mix the pure carbolic acid with half of the wood charcoal thoroughly; mix the iodine with the other half, and mix together.

2. ℞ Ammonii carbonat.	31	Gm.	or ℥j.
Carb. ligni	15|5	Gm.	or ℥ss.
Camphoræ	4	Gm.	or 3j.

M. Add Numbers 1 and 2 lightly together, add 1.20 c.cm. (or *m*xx) of oil of lavender, and as much compound tincture of benzoin as is needful to make a thick paste, and put in a wide-stoppered bottle. (Mr. Durham, of London.[1])

The following is Brand's (of Vienna) remedy for acute coryza, and is much used as an inhalation for nasal catarrh and coryza:—

℞ Phenol. liq.,
Aq. ammoniæ fort. ..... aa 18|5 c.cm. or f3v.
Alcoholis ..... 60| c.cm. or f℥ij.
M. Sig.: Keep in a dark place or in a tinted glass bottle.

A few drops are to be poured on blotting-paper, and this rolled into a cone, and the vapor inhaled as long as it rises. The eyes should be kept closed, on account of the irritating nature of the vapor.

℞ Camphoræ ..... 4| Gm. or 3j.
Sig.: Add to 473 c.cm. (or Oj) of boiling water, and inhale the vapor, for acute coryza.

Beverly Robinson also recommends the following:—

℞ Phenol. liq. ..... 4| Gm. or 3j.
Creosoti ..... 4| c.cm. or f3j.
Tinct. iodi ..... 15| c.cm. or f3iv.
Alcohol. ..... 30| c.cm. or f℥j.
M. Sig.: For inhalation.

℞ Ol. pini sylvestris ..... 4| c.cm. or f3j.
Succus conii,
Tinct. benzoin. co. ..... aa 7|5 c.cm. or f3ij.
Magnesii carb. ..... 2| Gm. or 3ss.
Aquæ ..... 30| c.cm. or f℥j.
M. Sig.: For inhalation with a nasal inhaler.

By employing a receptacle holding hot water (a pint or less), the volatilization is hastened by the heat, and the effect is more powerful. In the dry form of catarrh, steam fumigation or atomization is better than the dry inhalation. The following require hot water:—

℞ Tinct. benzoini co. ..... 30| c.cm. or f℥j.
Sig.: A teaspoonful for each inhalation.

℞ Ol. pini sylvestris ..... 7|5 c.cm. or f3ij.
Magnesii carb. ..... 6| Gm. or 3iss.
Aquæ ..... q. s. ad 90| c.cm. or f℥iij.—M.

Or the following:—

℞ Creosoti ..... 15| c.cm. or f3iv.
Magnesii carb. ..... 4| Gm. or 3j.
Aquæ ..... q. s. ad 90| c.cm. or f℥iij.
M. Sig.: A teaspoonful for inhalation. (Robinson.)

℞ Tinct. iodi co. ..... 30| c.cm. or f℥j.
M. Sig.: For an inhalation 0.6 to 1.2 c.cm. (or *m*x-xx).

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[1] From "Nasal Catarrh and Allied Diseases," by Beverly Robinson, second edition, New York, 1885.

℞ Amylis nitritis ..... 4| c.cm. or f3j.

M. Sig.: From 0.18 to 0.30 c.cm. (or *m*iii-v) may be inhaled from a handkerchief; or small, glass pearls, each containing the required dose, may be used in the same manner.

℞ Chloroformi ..... 4| c.cm. or f3j.
Tinct. lavandulæ co. ..... 11| c.cm. or f3iij.

M. Sig.: A few drops may be inhaled for irritative cough, as in phthisis.

The following, which is known as Dobell's formula, is very largely employed as a detergent (Dr. Robinson uses thymol in place of carbolic acid):—

℞ Phenol. liq. ..... 2|60 Gm. or gr. xl.
Sodii borat.,
Sodii bicarb. ..... aa 8| Gm. or 3ij.
Glycerini ..... 26| c.cm. or f3vij.
Aquæ ..... 90| c.cm. or f3iij.

M. Sig.: Solution for nasal spray to be used with the atomizer.

℞ Acidi salicylici ..... 4| Gm. or 3j.
Sodii borat.,
Sodii phosphat. ..... aa 8| Gm. or 3ij.
Chlorali hydrati ..... 1|3 Gm. or gr. xx.
Glycerini,
Aquæ rosæ .....aa 30| c.cm. or f3j.
Aquæ .....q. s. ad 240| c.cm. or f3viij.

M. Sig.: Use frequently in initial stage of acute coryza.

The late Morell Mackenzie[1] recommended the following:—

Antiseptic Nasal Sprays or Nebulæ.

℞ Phenolis liquidi puri ..... |2 Gm. or gr. iij.
Aquæ ..... 30| c.cm. or f3j.—M.

℞ Tr. iodi ..... |18 c.cm. or *m*iij.
Glyceriti acid. tannici ..... |75 c.cm. or *m*xij.
Aquæ dest. ..... q. s. ad 30| c.cm. or f3j.—M.

℞ Iodoform. ..... 2|6 Gm. or gr. xl.
Æther. (sp. gr., 0.735) ..... 30| c.cm. or f3j.—M.

℞ Potassii permanganat. ..... |32 Gm. or gr. v.
Aquæ ..... 30| c.cm. or f3j.—M.

℞ Sodii benzoat. ..... 1|3 Gm. or gr. xx.
Aquæ ..... 30| c.cm. or f3j.—M.

℞ Iodated zinc caustic ..... |75 Gm. or gr. xii or more.
Aquæ dest. ..... 30| c.cm. or f3j.—M.

Astringent Sprays.

℞ Acidi tannici ..... |32 Gm. or gr. v.
Aquæ ..... 30| c.cm. or f3j.—M.

℞ Liq. alumin. chloridi ..... |18 c.cm. or *m*iij.
Aq. dest. ..... 30| c.cm. or f3j.—M.

Alumen.	50 Gm. to 30	c.cm. or gr. viii-f3j.
Ferro-alumen.	20 Gm. to 30	c.cm. or gr. iii-f3j.
Ferri perchloridi	18 c.cm. to 30	c.cm. or *m*iii-f3j.
Ferri sulphas	13 Gm. to 30	c.cm. or gr. ii-f3j.
Zinci chloridi	13 Gm. to 30	c.cm. or gr. ii-f3j.
Zinci sulphat.	32 Gm. to 30	c.cm. or gr. v-f3j.

[1] "Diseases of the Throat and Nose," Morell Mackenzie, London, 1884.

Detergent Sprays.

Dobell's solution.		
Potassii chloratis	1|3 Gm. to 30|	c.cm. or gr. xx-f℥j.
Sodii chloridi	|32 Gm. to 30|	c.cm. or gr. v-f℥j.

Sedative Sprays.

Potass. bromidi	1|3 Gm. to 30|	c.cm. or gr. xx-f℥j.
℞ Tr. belladonnæ	|6	c.cm. or *m*x.
Aquæ calcis	30|	c.cm. or f℥j.—M.

Antiseptic Sprays.

Liq. calcis	q. s.	
Sodii salicylat.	1|3 Gm. to 30|	c.cm. or gr. xx-f℥j.
℞ Acidi lactici	2|	c.cm. or *m*xxx.
Aquæ	30|	c.cm. or f℥j.—M.

There is often an advantage in having the liquid warm before spraying; this is not required when the steam-atomizer is used.

HYDROTHERAPY AND BALNEOTHERAPY.

The medicinal application of water by any method comes, strictly speaking, under the domain of hydrotherapeutics, which is, therefore, a very comprehensive term. Hydrotherapy (ὑδωρ, water, and θεραπεύω, I treat) comprises both the internal and the external use of water in the treatment of disease. The numerous forms of external administration—by wet packs, showers, douches, sitz or partial, plunge, and hot and cold baths—have given greater importance to the latter of these methods, so that the popular idea of "water-cure" is that it is mainly a course of bathing. Balneotherapeutics (βαλανεῖον, a bath, and θεραπεύω, I treat) is that department of therapeutics which deals with the application of baths in the treatment of disease, the different varieties of which will presently be considered in detail. The term "balneotherapeutics" is also applied more specifically to the science that treats of the effects of mineral waters and baths, especially as conducted at certain health resorts, known as "baths" or "springs." Leichtenstern, in von Ziemssen's "Hand-book of Therapeutics," defines balneotherapy as "the science of the therapeutical application of mineral waters," or "the science of the method and mode of operation of bath- and well- cures." In connection, therefore, with this topic, the composition and character, also the physiological and therapeutical effects, of various more or less celebrated mineral springs, require to be considered somewhat in detail. At the outset of our discussion of the therapeutical applications of water and water-dressings, we encounter the difficulty, as pointed out in the instructive and highly valuable little treatise of Dr. Simon Baruch,[1] of the existence of a belief on the part of many enthusiastic advocates of hydropathy that it is a panacea, and that it is a complete system of therapeutics rivaling regular medicine, and destined, finally, to overcome it. This is unfortunate, since it has led to the establishment of "water-cure" establishments for the treatment of all

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[1] "Uses of Water in Modern Medicine," Physicians' Leisure Library, Detroit, 1892.

diseases, and too frequently these are carried on in an empirical manner, under the control of ignorant laymen or irregular practitioners. Moreover, the influence of Priessnitz, who, by occupation, was a farmer, but who was an ardent advocate of hydropathic treatment for all diseases, is still felt by his successors; so that there is still, in some quarters, decided antagonism between the practitioners of scientific medicine and the sect of so-called hydropathic physicians. This reproach of hydrotherapeutics is now about to be done away with. Of late years the subject has attracted the attention of able investigators and teachers, among whom stands, notably, Professor Winternitz, who by Dr. Baruch is styled the father of modern hydrotherapy, and who is the author of the able treatise upon this subject in the fifth volume of von Ziemssen's "Hand-book of Therapeutics."

Historical.—It is simple justice to the ancient physicians to state that the therapeutical, as well as the hygienic, value of water and bathing was highly appreciated by them. In the "Vedas" of Susrotas water is often spoken of as an article of dietetic treatment, and even as an antidote, the number and the times of the baths being exactly regulated, and, indeed, with great minuteness of detail. In ancient Greece, in the midst of groves rich in springs, and in the vicinity of thermal springs particularly, stood temples dedicated to Æsculapius. Prayer, fasting, and bathing were conducted, under the strict rules of the priests, and, after the patients had pursued the required course, a votive offering was made containing brief notes of the symptoms and treatment. In the halls of these temples Hippocrates found a rich mine of therapeutical literature, which he utilized with the hand and brain of a master. It is not surprising, therefore, that his system of pathology was principally humoral, and that water played an important part in his therapeutics. "He was the first to maintain that cold water warms, while warm water cools, the body. He was acquainted with shower-baths and shampooing; he noticed that warm showers induce sleep, and cold water, poured over the body, is useful in fainting. He treated tetanus with showers, and in affections of the joints he recommended the pouring over of cold water as being useful in relieving the pain and curing the affection. 'Articulorum tumores et dolores absque ulcere et podagricas affectiones . . . frigida large effusa (aqua) levat et minuit, doloremque solvit.' Withal, his views on the hygienic value of water were remarkably enlightened. He says, in the 'Tractatus de Aëre, Aqua, et Locis, that 'the first duty of the physician, when he comes to a town, is to become acquainted with the peculiarities of the waters used there—whether they are boggy, or hard, or soft, and whether they come from hills or rocks,' etc. Since elevation of temperature was known to him as a symptom of fever, he recommends the use of cold water against the different varieties of it; even the reactionary influence of cold applications was not unknown to him." He also understood the principle of revulsion, as well as the heat-abstracting action of cold-water applications. "We perceive, also," continues Winternitz, "in the introduction of therapeutical principles true to nature, the first important beginnings of hydrotherapeusis in scientific medicine. From this time, water commands a place in therapeutics, and, since its soothing and anti-inflammatory properties are the most striking, we see how it is taken up by the different medical schools," all making greater or less use of it, even with fundamental doctrines as much at variance as the humoralists or physiaters and methodists, or the dogmatists and empirics. In the

writings of Galen due recognition is made of the value of water in therapeutics. With the exception of the celebrated code of health of the School of Salernum, however, the writings of the middle ages contain little reference to this method. In the seventeenth century it began to receive greater recognition, especially in England (Floyer; T. Smith), and, in the beginning of the eighteenth century, in Germany. F. Hoffmann and Hahn, toward the middle of the last century, advocated cold sponging in fevers.

Hydrotherapy received greater impetus toward the latter part of the century, in England, by the writings of James Currie, William Wright, and W. Jackson. The method was subsequently advocated by Reuss, Frohlich, Brandis, Horn, and others. About 1743, John Sigmund Hahn, in Germany, systematized the practice of hydropathy, but it was falling again into disuse, when, soon after 1820, Vincent Priessnitz, a small farmer of Graefenberg, in Silesia, began to treat every kind of ailment, chronic as well as acute, with various hydrotherapeutic procedures, and added to the external applications the abundant internal use of water, combined with active exercise and a very simple diet, prohibiting, at the same time, all alcoholic beverages, and also tea and coffee.[1] The error of Priessnitz has already been referred to, and is one that medical-system makers generally fall into. It was that there is a universal method of treatment applicable to all cases. He, however, succeeded in making the medical value of water to be better appreciated by both the profession and the laity, and the *furor* which his treatment excited was of great value to regular medicine, in directing attention again to this highly-important therapeutical resource.

Among contemporaneous writers, we may mention Ernest Brand, who published his work in 1861, showing remarkably favorable results, especially in typhoid fever, following immersion and compresses at from 54° to 68° F. Beutels, Jürgensen, Winternitz, Charcot, Valleix, Dujardin-Beaumetz, and numerous other authorities and teachers have, by their labors, brought the science of hydropathy into system, and greatly advanced its practice.

Kneippism is a more recent development of hydropathy, under the direction of an enthusiast almost as ignorant of medicine as Priessnitz, and, in his methods and results, curiously recalling to our mind the history of that great empiric. The Abbé Kneipp, having read Hahn's book, and cured himself by the liberal use of cold water, according to its directions, he has ever since been a zealous advocate of cold water as a remedy for all diseases. Dr. L. Reuss[2] thus describes his method:—

He undertakes to cure a long list of maladies, from asthma to shingles. For each of these maladies, Vater Kneipp's principal, if not his only, medicine is cold water, applied in the shape of douches, foot-baths, head-baths, sitting-baths, and so on. Given in the form of drink, the water is often mixed with infusions, decoctions, or alcoholic tinctures. Always, however, water is the base of the medication. The simples recommended by the abbé are very numerous, and the country people know them well. The leaves and flowers and roots and berries which he uses can be found, with few exceptions, at all our herbalists.

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[1] Herrmann Weber: "Quain's Medical Dictionary," p. 667.

[2] *Annales d'Hygiène Publique et de Médecine Legale; Times and Register*, May 7, 1892, from *Literary Digest*.

The worthy abbé's system, however, is not one of therapeutics alone; it is also one of hygiene. He maintains that the many diseases of our day—affections of the heart or the chest, gastritis, anæmia, nervous disorders—were almost unknown to our ancestors, and are the result of our bad mode of living. He declares that the most of our maladies are due to trouble in the circulation of the blood. To remedy this, the body should be subjected to the action of the exterior air, combined or not with the action of icy-cold water. Children should be allowed to go without shoes or stockings. Adults should often walk in the fields, even in winter, barefooted. In winter a walk with bare feet in the snow is absolutely recommended, only the snow should be fine, like dust, freshly fallen, and there should not be a cold and piercing wind blowing. The length of this snow walk should not exceed three or four minutes. A walk in running water has an incontestable tonic effect.

To keep well, according to Kneipp, you must dress and eat according to a certain system. You must discard woolen clothing next to the skin. Kneipp declares that if wool develops more heat than other cloth, it does so to the detriment of the human body. You must wear next to the skin a shirt of coarse cloth, as coarse as that of which grain-sacks are made. Fur collars, fur gloves, knit vests, and shawls, and all that sort of thing, must be absolutely discarded.

Finally, if people want to get well and stay well, they must change their diet and drink. They must eat food which is richest in nitrogen,—milk, cheese, peas, beans, lentils, meat, and fish. They must avoid food poor in nitrogen, like the cereals, potatoes, vegetables generally, and fruits, and have nothing to do with fats and oils. They must drink a minimum of wine, of cider, of beer, and have nothing to do with brandy. Coffee, with or without milk, chocolate, and tea are anathematized, especially coffee with milk, which debilitates the stomach, leaving it without digesting. Coffee with milk and beer, Kneipp counsels to replace with coffee prepared from acorns or with malt. This drink (Kneipp coffee) has nutritive and sedative qualities, in which ordinary coffee is absolutely lacking, and has also an excellent taste.

"Such is Kneippism. Whether it will make the tour of the world or even the tour of all Germany, the future alone can disclose. At all events, the system, if it cannot be recommended in its entirety, is not without commendable features."

At the present day, the achievements of hydrotherapy and the advancement of physiological and pathological knowledge demand from every intelligent physician an attentive investigation of its principles and practice. If this should be generally done, it will, beyond doubt, lead to a more general employment of such a valuable therapeutical aid. Professor Peter, of Paris, indeed, went so far as to declare, in his preface to Duval's "Hydrotherapie," that "hydrotherapy suffices, in most cases of disease; added to other treatment, it is a most powerful auxiliary. Can anyone speak better or say more of it?"[1]

Physiological Effects.—The erroneous idea has gained ground that the only object of bathing, in acute diseases, is reduction of temperature. It is true that pyrexia can be modified or reduced by this means, but other phys-

[1] Quoted by S. Baruch, *loc. cit.*, vol. i, p. 12.

iological and therapeutical results are produced, as will be seen from the following brief review of the physiological effects of water:—

Thirst is the sensation analogous to hunger experienced as a result of privation from water or fluids, after profuse watery discharges or hæmorrhages, and also as a result of the drying up of secretions, in some cases of fever. Life cannot be sustained without constant renewal of the water of the organism, to replace that lost by excretion, exhalation, and evaporation. Tissue-change and its functions are dependent upon the presence of water in sufficient quantity. This is partly supplied by the water contained in our food, and partly by the water which is drunk. Temporary excess of supply leads to increased discharge by the excretions and enhanced metabolism; whereas, relative deficiency produces a diminution in the quantity of the excretions. Where the increased ingestion of water continues for several days, it is observed that the volume of the blood is increased, and there is an increased removal of the products of retrogressive tissue-change; the blood, the tissues, and the kidneys being, so to speak, washed out by it. The urine is more abundant and the solids are slightly increased. In consequence of the removal of the used-up material, the organism is able to take up a larger quantity of new nutritive substances. As a result, if not carried to excess, so as to disturb digestion, plentiful water-drinking causes increase of bodily weight; the urine, the saliva, bile, pancreatic and intestinal juices, and the perspiration are increased; the proportionate increase being determined by circumstances of temperature and bodily exercise, clothing, etc. The acknowledged benefits from a course of mineral waters are largely due to the increased quantity of water swallowed, and it is found that certain remedies, such as potassium iodide, are more efficacious when given largely diluted with water, and many pharmaceutical preparations must be given diluted, more or less, in order to make them less obnoxious to the palate.

Excessive water-drinking, especially of ice-water, causes digestive disorder; but what constitutes excess is relative, and not absolute, since some persons may, without apparent ill effect, take quantities which would be injurious to others. Used systematically, water increases the watery contents of the stools and favors peristalsis, but excessive water-drinking dilutes the gastric juice and tends to produce diarrhœa. It reduces the density of the blood, and may interefere with the nutrition of the great nerve-centres and of the heart.

The external uses of water produce different physiological effects in accordance with the mode, duration, and time of application. The primary effects are local or general abstraction of heat and the stimulation of greater or less cutaneous areas. Indirectly, we have stimulation of the nerve-centres and disturbance of function of the vasomotor system, and the resulting effects upon metabolism, excretion, and assimilation. Hydrotherapeutic measures, apart from their antipyretic applications, are sometimes divided into stimulant and calmative, but no exact line can be drawn between these two classes. Among the former, the full, or plunge, bath; cold-rain or shower- bath; the douche, the spray- or needle- bath (circular shower-bath), sponge- or towel- bath, of short duration, usually preceded and followed by friction of the skin, are most used. The observations of Winternitz have shown that cold baths increase the absorption of oxygen and the elimination of carbonic acid. A hot bath is a powerful nervous **stimulant.** The stimulating effects of these are shown in the reaction which follows, accompanied

by a sense of exhilaration. Where the reaction does not occur, and the patient is blue and depressed after the bath, it fails of the anticipated good effect, and will be injurious, if continued. Some individuals have an idiosyncrasy in this respect, but where this is due solely to being unaccustomed to bathing it can be overcome by a system of graduated baths. By altering the temperature and duration of the bath, the effects may be considerably modified. The **calmative** effects are obtained from the wet pack, in which the patient is enveloped in a wet sheet and rolled up in blankets; wet compresses; the hot foot-bath; the sitz-bath; the warm bath without motion. The effects noticed are abstraction of heat, diminution of nervous irritability of sensation, and mental activity, also, of the force and frequency of the heart's action. There is a feeling of lassitude and a tendency to sleep. As suggested by Weber (*loc. cit.*), "These forms of application can be modified, and the effects will vary in proportion. Thus, the wet-sheet envelope allows ample variation by using warm or cold water; by using the sheet dripping, or wrung out; by making the sheet fit tightly around the neck; by moving the sheet to and fro; by frequently changing the sheet, etc. The calming and stimulating form may be further combined by using, first, the wet-sheet envelope, or the woolen-blanket envelope, for a sufficient period to produce perspiration, and then a more or less cold bath or shower-bath of short duration." The various forms of hot-air and steam baths, combined with douches and baths of various temperatures, in the forms commonly known as Turkish, Roman, or Russian baths, are powerful hydrotherapeutic helps.

Ice may be applied so as to act as a stimulant, or, on the other hand, as an antipyretic and sedative. To obtain the former effect, pieces of ice are applied suddenly to different portions of the surface of the body, thus exciting reflex action and stimulating the vasomotor nerves. They may also be introduced into the rectum in chloroform or ether narcosis, as recommended by the late S. D. Gross. The ice-bag will often relieve pain.

Obstetricians sometimes excite the uterus to contraction in post-partum hæmorrhage by inserting ice into the cavity. Applied over a nerve, ice may produce anæsthesia, or even paresis of its peripheral fibres. Weir Mitchell demonstrated that anatomical changes may be produced by intense cold applied to the nerves, such as congestion with or without sanguineous exudations. Briefly applied, cold produces a rapidly-passing congestion without leaving traces behind, but, if prolonged, the nerve increases in volume, chiefly by dilatation of its blood-vessels. There may be actual effusions in the structure of the nerve, producing more or less paralysis in the parts supplied by it, but they usually disappear, although some of the nerve-fibres may degenerate. "Thus," says Baruch, "we may account for some cases of acute neuralgia, myelitis, and acute spinal paralysis following great temperature effects." All observers are agreed upon one point which is of great importance in clinical hydrotherapy, to wit: "an evanescent thermic application excites, while a prolonged one depresses." There is a more energetic reaction when the transition is abrupt from hot to cold, or the reverse, than where it is graduated.

Irrigation of the mucous cavities of the bodies by large amounts of fluid is a well-known and valued therapeutic measure. Large cold-water enemata have been used as a means of reducing temperature in typhoid fever; injections of warm water break up masses of fæces and cause evacua-

tion of the large bowel; irrigation of the stomach removes mucus and acts as an antiseptic. Hot water is an excellent styptic and antiseptic.

The late Dr. John M. Keating urged the use of large hot-water injections into the rectum, the patient using the fountain-syringe before retiring at night, as an assistance in breaking up utero-rectal attachments and reducing backward displacements of the uetrus. While making the injection the patient should be in the knee-chest position.

The practice introduced by Krull, of treating catarrhal jaundice by means of cold enemata, has found many supporters. On the first day from 800 to 1600 c.cm. (or $1\,^3/_4$ to $3\,^1/_2$ pints) of water at 59° F. are injected, and on succeeding days the temperature is gradually raised to 72.5° F. The appetite improves from the first, the hepatic and epigastric sensibility is next relieved, and the strength increases. The method is said to succeed in four to six days in recent cases or those of some weeks' duration. The removal of the obstruction is accompanied and followed by polyuria, with increased excretion of urea. The injections produce intestinal peristalsis and overcome constipation. They also remove septic matter from the bowel and facilitate the expulsion of calculi.

Clinical Applications of Water in the Treatment of Disease.—In the author's work on "Heredity, Health, and Personal Beauty"[1] the relationship existing between bathing and health is especially considered in the chapters on "The Bath as Promotive of Health and Beauty" and on "Bathing as Practiced in Ancient and Modern Times."

The internal uses of water have already been suggested; it is indispensable both in health and disease. It is owed largely to the late Dr. Hiram Corson and Dr. J. F. Meigs that the practice of refusing water to children during fever has been abandoned; and the fever-thirst is no longer met by small sips of hot water, but the patient is allowed to drink freely of cold water, which reduces temperature, slows the pulse and makes it fuller, favors diaphoresis and excretion, and washes out the kidneys. As a matter of precaution, it is considered advisable to filter and boil water, so as to render it aseptic, especially when epidemics of typhoid fever, cholera, dysentery, and similar diseases prevail. In the treatment of **chronic gastric catarrh** hot water plays a very important part. Since it is capable of flushing the stomach and washing out the collection of *débris* and mucus, with bacterial and other microbic colonies, it relieves nausea and favors appetite and digestion. Many persons have tried hot water for their **dyspepsia**, as it was a fad a few years ago, and afterward abandoned it because it did them no good. The fact is that they used it improperly, and drank a cup of hot water just as they sat down to a meal. If they had taken professional advice they would have learned that they should take from 240 to 473 c.cm. (or f℥viii-xvj) of hot water at least half an hour before each meal, and in some cases an hour is better. The water should be too hot to drink, and should be merely sipped or taken by the teaspoonful. When this has been faithfully done for a short time patients are astonished by their improvement. Nausea disappears, appetite returns, digestion is facilitated, and constipation overcome. It may be necessary to order some compound tincture of gentian or cardamom, or similar stomachics, to be added to the water, in order to insure obedience and perseverance. In the temporary arrest of secretions

[1] Published by The F. A. Davis Company, Philadelphia, 1890.

and suspended digestion accompanying **fever**, water plays an important part in keeping the mouth and throat from being parched, and in removing mucus and epithelial *débris* from the intestinal and urinary tracts. Fever patients should, therefore, be encouraged to drink pure water. The thirst is often better relieved by carbonated water, such as Vichy or Giesshübler. M. Debove lays great stress upon the administration of water in typhoid fever. M. Maillart, of Geneva, who has particularly studied this subject, writes that water-drinking should be regarded as a special method of treatment. He recommends that the patient should drink five or six quarts of water during the day. This practice has a good effect in reducing temperature, it allays nervous excitability and promotes the action of the kidneys. The quantity of perspiration and urine is augmented, and a large amount of urea is removed from the system. When the stomach contains objectionable material, the simplest **emetic** is water, heated to about 90° F., into which salt or mustard may be stirred if desired; but the water should be supplied to the full capacity of the stomach, since it acts principally mechanically.

In **summer diarrhœa of infants** the following method is successful in washing out the intestinal tube: A soft-rubber tube, such as No. 8 Nélaton or Jacques catheter, is gently, but firmly, pushed through the pharynx into the stomach of the child, which is held upright in the nurse's arms. In very many infants this is not a difficult procedure, as they will aid it by sucking the tube. In older children it is more difficult, and had better be avoided. The procedure should not be made in the presence of the mother, nor of anxious friends, if it can be avoided, because the occasional anxious and cyanotic appearance of the baby, although evanescent, and not denoting harm, will interfere with the procedure in many instances. The catheter being lodged in the stomach, it is connected with a fountain-syringe, from which simple, boiled water, of 95° F., is poured. The infant will probably vomit, but it is better to disconnect the catheter from the syringe, and allow the water containing products of fermentation, mucus, and undigested curds to escape through the tube. If the tube be not firmly held, it will be vomited (Baruch). This brings up the question of irrigation of the stomach, or **lavage**, as it is called by the French. Lavage is both a diagnostic and a therapeutic agent. The technique, as followed by Baruch, is as follows: The patient is told to eat a hearty meal at 12.30 P.M., and to present himself at 5.30 P.M. for irrigation of the stomach by tepid water. "A long, soft, but firm rubber tube, with open end, and one eye near the latter, is introduced into the stomach. The necessary quantity of warm water (usually 2 to 6 litres, or about 2 to 6 quarts) being in readiness, a basin is placed upon a chair in front of the patient. It is well to protect the clothing of the latter by a doubled sheet,—or, what I use in my office, an oil-cloth apron,—secured around the neck and reaching over the knees. Artificial teeth, if present, are to be removed. The patient is requested to sit upright, with his head thrown back. The physician, standing on the right, dips the lower end of the tube in warm water (oil is unnecessary, and injures the tube eventually). Holding it between the thumb and forefinger, he introduces it over the tongue until it strikes the back of the pharynx. The patient is now told to bend his head forward. In the first effort gagging will ensue, but an abundant mucus is secreted in the throat, which lubricates the tube. The patient should be reassured, if he feels choked or distressed, by informing him that this is the usual effect, and that, if he will keep his mouth well open, he

cannot choke, because there is ample room in the pharynx for a larger tube. The physician must refrain from sharing the patient's excitement, and, by his calm demeanor, reassure him when he, as is often the case, protests that he is utterly unable to do his bidding." If a spasmodic contraction of the œsophagus should occur, the operator should wait a few moments and have the assistant pour some warm water down the tube. The tube can then gently pass down into the stomach, the distance having first been measured externally and a mark placed upon the tube showing how far it should pass into the mouth. When in position, the warm water is poured into a funnel at the free extremity of the tube, from whence it passes to the stomach. If vomiting ensue, the patient is instructed to lean forward over the basin and allow the vomit to flow out around the tube and partly through it. If the lower end of the tube become blocked up with undigested food, the funnel may be held higher up, so that the water may flow with greater force. After a half litre (or f℥xvij) or so, according to the case, has been injected, the funnel end is promptly depressed into the basin, and a reverse current is set up by siphonage from the stomach. This should be done quickly, as suggested by Baruch, **while the water is still flowing,** in order to establish siphonage. A neglect of this simple point defeats the proper emptying of the stomach. This procedure should be repeated until the stomach is thoroughly washed, even if several gallons are required, using no larger quantity at each injection than a pint. The washings are now carefully inspected. If there is undigested food in quantity, it denotes feeble digestion; if there is much gastric mucus floating on the surface, in a thick, tenacious, brown mass, it indicates gastric catarrh; if stringy mucus is present, it generally comes from the throat or gullet; a red tinge to the water suggests that an ulcer is probably present, in which case further use of the stomach-tube should be suspended. In gastric catarrh, systematic washing out of the stomach is of the greatest service, in conjunction with proper diet and the usual remedies. The irrigation may be practiced with warm Carlsbad or Vichy water, dilute solutions of boric acid, borax, or nitrate of silver, or simply recently-boiled water, every morning, or every second morning, gradually increasing the intervals as the patient improves. Dr. Baruch cites cases of nervous dyspepsia, in which there was neither mucus nor undigested food in the washings of the stomach, in whom hygienic management and hydrotherapy, externally applied, was successful after all the ordinary remedies had been tried in vain. As regards the time of day, Küssmaul, who, in 1867, introduced this method of treating stomach disorders, selects the morning, before breakfast. Riegel and others assign good reasons for preferring the evening, just before retiring to bed; while Baruch prefers the afternoon, about 5.30 o'clock, the dinner having been taken at 12.30. In fact, much must be left to the judgment of the physician and his understanding of the requirement of the particular case in hand. A word should be here said about the abuses and possible dangers of lavage and irrigation of the stomach. Cases have been reported of unfavorable results following the use of the stomach-tube, and several cases of boric-acid poisoning have resulted. It is evident that great care should be exercised, and that the operator should proceed cautiously at first, especially where there may be a gastric ulcer, or with a nervous patient.

Bathing is a very ancient therapeutical resource. The limits of the present article only permit a very insufficient outline of its applications in

medicine. The baths may be general or local. Of general baths, we recognize the plain and the medicated, and, as regards temperature, we have cold, warm, and hot baths. Baths of hot air, or Turkish baths, and of steam (either plain or aromatic) have been already mentioned. The present consideration is restricted to baths by immersion of the body in water, either plain or containing substances in solution. It has been established by recent investigations that absorption through the skin, during a brief immersion in a bath, is practically impossible, and that, therefore, medicated baths are useful only for their direct effects upon the skin. There is little, if any, absorption in a cold bath, and absolutely none in a hot bath. When it is desired to administer remedies for their constitutional effects by the route of the skin, the drugs should not be put into the bath at all, but should be applied to the skin after the bath, upon compresses or by inunction. This will be referred to again, under local hydrotherapeutics.

Baths are called cold, tepid, warm, or hot, according to the temperature of the water. By a **cold** plunge is meant immersion of the body in water below the temperature of 70° F. Anything below 50° F. is considered a very cold bath. In some rare instances of hyperpyrexia, we may even add pieces of ice to the water, as in the treatment of **sun-stroke.** The **tepid** baths, of a temperature of 75° to 95° F., are intermediate between cold and warm baths. The **warm** bath is from 95° to 104° F. Above this is a **hot** bath, and very hot baths may be given up to a temperature of 114° F. As already intimated, the physiological effects depend upon the temperature and duration of the bath. Under ordinary circumstances, when no time is mentioned, the duration depends upon the objects sought to be attained by the baths and personal convenience. Prolonged immersion is sometimes practiced in some surgical cases and in skin diseases. The **cold** bath should be brief, as the rule, and followed by friction with the flesh-brush or coarse towel. This expedient is most valuable in invigorating the system, and is utilized in the treatment of catarrh, in conjunction with local treatment. Some patients bear cold better than others, but prolonged immersion is depressing, owing to continued loss of heat. The secondary effects of cold bathing—which accelerates tissue-change, augments the excretion of carbon dioxide and of urea from the system, and improves the appetite—are used to advantage in many chronic disorders, and particularly in **lithæmia** and **rheumatism.** Cold sea-bathing has an important part in favoring **neurasthenia,** especially in children; but in many instances it should be preceded by a graduated system of warm bathing, until the patient is strong enough to bear the shock of the plunge. Where motion of the body, as in swimming, is combined with the cold bath, the depressing effects are less than when the subject is kept quiet. The hygienic effects of a stay at the sea-shore also enter into the advantage of sea-bathing. Children afflicted with rachitis are generally improved by a sojourn at the sea-shore and the practice of sea-bathing. The **warm** bath is that generally resorted to for cleansing purposes, and is accompanied by frictions of the skin. It is without shock; it causes a moderate increase of capillary circulation, and scarcely affects the pulse. As the stay in a warm bath is generally longer than in a cold bath, the loss of heat may be actually greater than from a cold bath; hence the aphorism of Hippocrates, that "a cold bath warms and a warm bath cools." This is the form of bath which is generally resorted to in the treatment of fevers, and which will be referred to in detail in discussing the Brand

method of treating typhoid, or enteric, fever. **Hot** baths exert a powerful stimulating effect upon the nerves and blood-vessels of the skin, and are used in narcotic poisoning and in overcoming a tendency to coma in low fevers. Hot water injected into the rectum has been found useful in overcoming shock due to loss of blood or surgical operations. Professor Baelz, of Tokio, recommends the hot bath as a valuable measure in the treatment of capillary bronchitis, broncho-pneumonia, rheumatism, nephritis, and in the beginning of menstruation when accompanied by uterine colic.

Caution is to be observed in adapting the bath to the condition of the patient. Cold baths are fitted for the vigorous and robust, but even in them, as pointed out editorially in the *British Medical Journal*, it may be carried to excess and become injurious. Cold bathing every morning throughout the year may be conducted in such a way as to be beneficial, viz.: if the plunge be brief and be followed by friction of the skin and prompt dressing. But because it can be carried on with advantage by one person who reacts well after it, it does not follow that another can do it with impunity, especially if he finds that reaction is slow after the bath. In the latter a moderately warm plunge-bath or shower-bath might be borne well and be followed by beneficial results. Open-air bathing in winter is not likely to have many advocates in this uncertain climate, but it appears that it finds some defenders in England, where school-boys, who do not like to be outdone by their seniors, we learn, are in the habit of taking a cold bath before the morning-school. This is apt to be injurious to the weakly ones, and to retard development in the strong unless followed by running or other active exercise, to restore the circulation. Cold baths should never be taken when exhausted or directly after a full meal, or if there be reason to suspect congestion of any internal organ. The anæmic and debilitated may combine the advantages of both the tepid and the cold bath by immersion in or sponging with warm water, followed (while still standing in warm water) by the rapid application of a sponge, wet with cold water, to the general surface or to the throat and chest. Asthenic persons are often unable to take a full bath, and subjects of vascular degeneration or heart disease should only use warm water. The excessive use of decidedly warm or hot baths is relaxing to the system and debilitating.

The treatment of **typhoid fever** by Brand's method requires a bath at 68° F. every three hours, where the rectal temperature is 102.2° F. or over, lasting about fifteen minutes, the patient's body and extremities being rubbed by attendants. With some modifications, this treatment of typhoid fever is now in general use, and a very marked improvement has been observed since its introduction. In the *Practitioner* for March, 1891, Dr. F. E. Hare, of Brisbane, analyzes two series of cases of typhoid fever,—the one including eighteen hundred and twenty-eight cases and treated expectantly, the other comprising eleven hundred and seventy-three cases and treated with cold baths. Dr. Hare deals most effectually with possible objections to his statistics. He shows that the treatment has no effect upon the occurrence of perforation and hæmorrhage beyond rendering the latter less dangerous; that the death-rate from exhaustion and from pulmonary and cerebral causes is diminished, especially in cases of early admission to the hospital; and that the prognosis becomes even better in women, since they are less liable to perforation and hæmorrhage than men. The lethal influence of the intestinal lesion is lessened under this treatment, by moderating

the diarrhœa and by sustaining the strength of the patient. Brand's rules and cautions as to contra-indications were observed. Dr. Hare incidentally remarks that quinine is of much service as a cardiac stimulant in simple pyrexial cardiac failure. The author concludes by saying that hospital mortality may be greatly reduced—upward of 50 per cent.—by the cold-bath treatment; but that it can hardly fall below 5 per cent., since the death-rate from perforation and hæmorrhage amounts fairly constantly to 4 1/2 per cent. As the result of the different liability of the sexes to these accidents, the prognosis under the bath treatment is vastly more favorable in females than in males, as above stated.

As this method requires a portable bath-tub, or subjects the patient to considerable disturbance of body, which is opposed to the first principle of treatment of typhoid, various methods have been devised to overcome this objection. The patient may be placed upon rubber cloth and the edges lifted up in such a way as to make the patient lie in a hollow, which may be partly filled with water of any desired temperature. Niemeyer's method is somewhat similar, the patient being enveloped in a wet sheet, and water, at the temperature of 70° F. or less, is then applied by means of a watering-pot or rose-spray. The late Professor Da Costa preferred cold sponging, repeated every hour or two when the temperature is over 102° F. The following is a method advocated by Dr. F. Peyre Porcher, of Charleston, S. C.:—

"1. A soft towel, folded, is soaked in a basin of iced water, then wrung out and applied over the forehead and temples.

"2. The palm of one hand and the arm are sponged off with another towel, which has been dipped in the cold water and wrung out.

"3. The towel which has been left upon the head is turned and reapplied, so as to have the cold surface next to the skin.

"4. The other hand and arm are treated as was the first.

"This process, strictly followed, is continued for fifteen, twenty, or thirty minutes, or until such time as the surfaces have become thoroughly cooled and blanched, when it may be discontinued,—to be renewed whenever there is a rise in the surface-heat. Sometimes, if it does not cause fatigue, both hands and arms, if hot and dry, are allowed to remain submerged, or be bathed directly in the cold water."[1]

The late Dujardin-Beaumetz was an advocate of the hydropathic treatment of typhoid fever, but was opposed to the cold bath. He summed up Brand's method as follows: "You must administer baths of 64° to 68° F., of fifteen minutes' duration, from the fifth day of the fever; these must be repeated day and night, every three hours, as long as the temperature of the rectum exceeds 102.2° F." In applying rigorously this treatment, so simple in appearance, Brand considered himself warranted in affirming that "every case of typhoid fever, treated regularly from the beginning by cold water, will be exempt from complications and will get well." The method of Brand is carried out rigorously at Lyons by Dr. Glenard, who reports such good results in his service that the method has extended to all the other hospitals of Lyons. Ziemssen reports a great reduction of mortality in Germany. At the same time Schmidt, of Erlangen, and others have shown that a rigorous application of the cold bath to typhoid-fever patients is not without its dangers, and the death-rate may be actually increased by it. Dujardin-

[1] "Transactions of the Association of American Physicians," vol. i, p. 29.

Beaumetz, after a review of the question, asserts that "the method of Brand is impracticable in the majority of cases and outside of military practice," and this applies to hospital as well as private practice. He bases this statement upon the fact that it is not possible to begin the practice as early as the fifth day in all cases, because many never enter the hospitals so early, and because at times we cannot be sure of our diagnosis till after the seventh day. Moreover, he justly states that "we cannot, without danger, subject all our fever patients to a rigorous and severe method, and where we are ignorant of the cause even of the febrile process." Since the cold bath may determine profound congestions, he declares that Brand's method is not free from danger, and is itself a cause of not a few complications, especially pulmonary congestions and inflammations. As regards intestinal hæmorrhage, he believes that in certain cases the cold baths may favor these hæmorrhages in patients who are predisposed.

In summing up, he says: "I consider the exclusive method of Brand, and the rigorous and mathematical rules which he has formulated, as deserving to be banished from the treatment of typhoid fever, and for this reason especially: because it requires, in order to derive from it all the results which it promises, to be applied before the diagnosis can be certain; for, employed later, this system only gives, according to the acknowledgments of the most zealous partisans, results comparable with those of other therapeutic methods, and with greater danger to the patients. . . . In fact, we have, for the treatment of certain manifestations of typhoid fever, hydrotherapeutic means much less dangerous and quite as powerful,—not, perhaps, from the point of view of hyperpyrexia, but from that of the other symptoms of typhoid fever; for, in my opinion, the advocates of refrigerant medication have committed an error in vociferating: 'The hyperpyrexia!—Behold the enemy!' The hyperpyrexia, as Peter has well said, does not constitute all the danger of the disease, of which it is only one of the manifestations."

Dujardin-Beaumetz[1] preferred the tepid bath or the **wet pack**, applied as follows: "The patient, in a state of nudity, is wrapped, from head to foot, in a sheet or blanket wrung out of ice-cold water. It is well, as a preliminary step, to have a rubber blanket spread upon a mattress; over this you place the wet sheet, in which you wrap your patient. Liebermeister advises that this envelopment should be continued for ten minutes; for my part, I prefer a shorter duration (of a minute or so), after which the patient is taken from the wet sheet and removed to his bed. If I prefer wet wrappings, of short duration, to the practice of Liebermeister, it is because I do not wish to obtain refrigeration from these envelopments, but only a regulative modification of the nervous system, and this effect will be the more marked the shorter the duration of the cold application. This is one of our most powerful modes of treatment, in cases of typhoid fever of ataxic and adynamic character. . . . Foltz has recently added cold lavements to the refrigerant medication. These lavements of water, at 50° F., lower the temperature of patients—in a feeble manner, it is true, but still appreciably,—and this is a fact worthy of being remembered."[2]

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[1] "Clinical Therapeutics," by Professor Dujardin-Beaumetz, p. 383. Translated by E. P. Hurd, M.D., Detroit, 1885.

[2] "Clinical Therapeutics," *loc. cit.*, p. 387.

The principal local applications of hydrotherapy consist of affusions or douches, compresses or partial packing, and local immersion. There are a variety of methods of administering douches: the shower-bath; the douche proper, in which a column of water falls or is projected upon the body; the needle-bath, in which several rings, at different levels, discharge minute streams of water, from all directions, upon the body; and the movable jet or spray. Where the force of the water is rather great, we should avoid douching the head. The douche may be, like the full bath, cold, temperate, or hot; but it has this advantage over the full bath, that the temperature may be abruptly changed, thus producing rapid alternations of temperature, which are decidedly stimulating to the nervous system, both central and peripheral.

In the so-called "Scotch douche"—a shower-bath, in which the temperature, at the beginning, is about 86 degrees, and is gradually raised to 122 degrees, which is about as hot as can be borne—this is followed immediately by a douche about as cold as ice. The duration of the douche should be very brief (ten to twenty seconds), and should be preceded by active exercises, to produce action of the glands of the skin. It is, therefore, a measure better adapted to vigorous persons than invalids. It can be utilized, however, in the manner described upon the preceding page as the method of Niemeyer. The cold shower is of service, when directed against disorders situated in various organs of the body, and, when followed by vigorous friction, or, as Gross recommended, whipping with the fringed edge of a towel, it is a powerful nutritive stimulant. The cold douche to the lumbar region stimulates the kidneys in suppression of urine; but in advanced Bright's disease the wet pack is better, on account of the free perspiration which it induces.

Dr. Hiram Corson, of Pennsylvania, highly recommended the cold douche in the delirium of **scarlatina** and other eruptive diseases, the water being poured from a pitcher, elevated a foot or two, and sufficient in quantity to reduce the temperature and delirium. The influence of cold water in reducing prolonged hyperpyrexia in scarlatina is admirably exemplified in the circumstantial history of a case published by Dr. Ch. Talamon, of Paris.[1] A high temperature with violent delirium and alarming adynamic condition had existed for seventeen days and cold affusions had been employed with temporary good effect when the systematic use of the cold bath, according to the method of Brand, exerted the first positive influence upon the fever, and was the only means which succeeded in definitely overcoming the hyperpyrexia. In the words of the reporter, "it may be said that the cold baths literally resuscitated this patient, and we are convinced that, had they been employed from the beginning, we should have obtained, in the early days of the disease, the result which was delayed until the twentieth day."

M. Levestre is a strong advocate of the use of cold baths in the pneumonia of children. He states that the temperature is reduced after each immersion, while the pulse and respiration were diminished in frequency. Defervescence usually occurred before the seventh day.

Dr. Thomas J. Mays, of Philadelphia, is a firm advocate of the application of ice-poultices in the croupous pneumonia of adults. The affected area

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[1] *La Médecine Moderne*, Sept. 15, 1892; *The Medical Bulletin*, Nov., 1892, p. 427.

is surrounded by rubber ice-bags well wrapped in towels and another is placed upon the head. Other writers have borne testimony to the value of this method of treatment. The cold douche to the spine is useful in chorea and in many other disorders of the spinal cord. The application of ice to the spine, for seasickness, chorea, etc., will be referred to in the chapter on "Cold and Heat" as therapeutic agents. The local application of moisture is largely employed in medicine, in the form of stupes, cataplasms, or poultices, and compresses; especially when used in connection with heat, it favors local hyperæmia and hastens the process of suppuration in abscesses and boils. This method is also useful in relieving pain and relaxing tissues, as where joints have become stiffened. Cold compresses, especially when some agent is added to favor evaporation, as alcohol, are useful in various forms of inflammation. A common resource in pharyngitis, tonsillitis, and inflammation of the throat attending scarlet fever and diphtheria is the application of wet compresses, which may be dipped in ice-water, as recommended by Dr. Hiram Corson.

To review the therapeutic applications of water, we would place at the head of the list the hydriatic treatment of **fever.** Dr. Baruch has pointed out[1] the principal reasons why this method is not in general use, as (1) it is believed by many to savor of quackery; (2) the difficulty of applying its principles, and necessity of apparatus; (3) the necessity and difficulty of an exact technique; and (4) the objection of patients and the natural aversion of some people to water. The main obstacle, however, is probably the absence of hydropathic teaching in the medical colleges, and want of appreciation by physicians of the advantages of this mode of treatment. Under the direction of the leading clinicians of Europe and this country, a rapid revolution is occurring in medical practice, and the expedients of hydropathy are coming into more general use as the knowledge of their utility and safety becomes more widely diffused among physicians and the community. In **typhoid fever,** some form of bathing is now universally resorted to for the relief of hyperpyrexia, although, as Dujardin-Beaumetz insisted, the effects of the bath upon the functions of the nervous system are of greater importance than the mere abstraction of heat, in favoring recovery and diminishing liability to complications. In scarlatina, measles, and other exanthemata the wet pack is useful in bringing out the eruption, relieving restlessness, and reducing fever temperature. In chronic metal poisoning (lead, mercury, arsenic) the increased perspiration favors elimination. In muscular rheumatism and lithæmia, and various forms of chronic rheumatic inflammation of organs, the wet pack and vapor-baths are very useful. A convenient method of obtaining a vapor-bath, without apparatus, is to strip the patient and envelop him in a wet sheet, then seat him upon a cane-seat chair. Under the chair, upon the floor, is placed a small alcohol-lamp, over which is a small receptacle filled with water. After lighting the lamp, the patient is covered with blankets, which pass from his neck to the floor, thus retaining the heat. In a few moments, perspiration will begin to come out, and profuse sweating will ensue. After ten or fifteen minutes the patient is allowed to lie down upon a bed, and is thoroughly dried with towels, followed by friction. If desired, medicinal substances may be combined with this bath. For instance, some pine-needle-oil (oil of pumilio pine) may be

[1] *Journal of Balneology,* March, 1892, p. 2.

added to the water. Some sulphur may be burned at the time that the skin is perspiring freely, or 0.65 to 1.30 Gm. (or gr. x-xx) of calomel or red oxide of mercury may be vaporized by placing them upon a metal plate, over the lamp, as a substitute for the water-pan after free diaphoresis has been produced.

Another method of causing diaphoresis, which is a combination of hot air and moisture, is conveniently used as follows: A small tin pipe (like a rain-spout) is obtained, which is rounded in the middle so that the ends are in planes at nearly a right angle to each other. The patient is placed in bed, upon a rubber sheet, covered by a blanket. The bedclothing is brought tightly around the neck and shoulders, but lifted from the remainder of the body by means of half-hoops, or other means of elevating the bedclothing, so as to make it into a hot-air chamber. The pipe is attached to the foot of the bed so that one end enters the cavity of the hot-air chamber and the other is outside, directed downward. Under the latter is placed a lighted alcohol-lamp, so that the heated air from the flame will pass into the pipe and be carried under the bedcovers. The patient will be made more comfortable by having a compress, wet with cold water, applied to his forehead during this period. After profuse perspiration has been excited and continued for the desired time, the patient is rubbed down and dried as before. This is of great advantage in chronic rheumatism, Bright's disease, uræmia, and similar conditions.

In **gouty** or **rheumatic inflammation,** restricted to certain joints, the local compress is serviceable, and good reports have been made of the application of 10-per-cent. solutions of salicylic acid or salicylate of sodium to the joints. By combining electricity with these compresses absorption is favored, and remarkably good results have been obtained, as has been already stated in the article upon electricity under "Electrolysis and the Cataphoric Action of the Galvanic Current."

In **syphilis** and **skin diseases** the bath is indispensable, and the application of various forms of hydrotherapy is set forth in more detail than is permissible here in the author's work[1] on "Diseases of the Skin."

The results obtained at the Montefiore Home by Dr. Baruch, in the treatment of **phthisis** by hydriatic measures, have been so successful that further trial of this method is recommended. The technique of these procedures varies with each case. Brief applications of low temperature, as by the douche or rain-bath, the wet pack, or rapid ablutions, are followed by rapid reactions, and, if well borne, are exceedingly useful as tonics; while, on the contrary, in cases suffering from elevated temperatures and great debility, more gentle procedures and higher temperatures are required. Dr. Baruch warns against too cold applications, which are better indicated in a febrile or mildly febrile condition. He gives the patients a thorough cleansing with soap and warm water upon entering the hospital, after which a day is allowed to elapse. "The patient is now wrapped snugly, quite naked, in a woolen blanket, so that his entire body is excluded from air; other blankets are piled over him; the windows are opened, and he is given a small glass of iced water every ten minutes. Having lain in this position an hour, now one part of the body is exposed and bathed as follows: A

[1] "A Practical Treatise on Diseases of the Skin," fourth edition. New York: D. Appleton & Co., 1901.

basin of water at 75 degrees is ready, into which the attendant dips his right hand, covered by a mitten or glove of Turkish toweling. With the wet glove the face is well bathed. Now, one arm is exposed and rapidly washed and rubbed, then dried and replaced under the blanket. Other parts are then successively treated. At the termination of this ablution the patient is rapidly rubbed all over with a coarse towel. The treatment is repeated daily, the temperature of the water being reduced 2 degrees on each occasion."[1] The next step is the dripping-sheet. "The patient, standing in a tub of water at 100° F., has a sheet, dipped in water at 70° F., thrown over his head and body from behind, and is wrapped completely and snugly in it. The attendant now passes his outstretched hands over successive parts of the body, with some pressure on the sheet. He rubs the **sheet**, not **with** the sheet. One or more pitchers of water, 5 to 10 degrees colder, are thrown upon the parts that have been subjected to friction. The sheet is removed and the patient thoroughly dried. This method requires great care and skillful application. Its success or failure depends upon ascertaining by previous treatment the reactive capacity of the patient. The most useful hydriatic procedure in phthisis, however, is the needle-bath. Unfortunately, this finely-divided douche can only be administered in institutions. The patient stands within a frame constructed of six semicircles of inch tubing, the upper one on a level with the clavicles. Each tube has three lines of fine perforations, the upper one directed upward, the middle straight forward, the lower downward. The water should have a fall of not less than forty feet. The temperature adapted to the average case of phthisis is 65° F. Here the pressure with which the water strikes the body affords a kind of massage, which assists in producing reaction even in feeble individuals. But it should not be applied without previous training of the skin, as above described. The rain-bath is an apyretic of great value if its temperature is not below 60 degrees nor above 70 degrees; it is a stimulant and tonic if between 55° and 65° F. The skin should become pink under it, and the patient must not be chilled by it; at least, any coldness he may experience should disappear after he is dried. **This, indeed, is the test of all hydriatic procedures.** Decided chilliness continuing after thorough drying and friction is an evidence of improper selection of the temperature, duration, and method of the bath. These should be modified as indicated by their effects." The progressive increase in weight and improvement of general condition in phthisis are accompanied by a diminution in the expectoration and the number of the bacilli.

Hydrotherapy in Nervous Diseases.—In many nervous affections disturbances of function are due to some obscure lesion or fault of nutrition, which can be removed or amended by judicious hydrotherapy. Professor Erb says: "Cold and cool baths, in various forms, belong to the most important therapeutically-active agents in the field. This method has, since it has been more carefully studied and more rationally pursued, made notable advances. Its results in all possible forms of chronic nerve-troubles are extraordinarily favorable. There are few remedies which have an equally-powerful influence upon the nervous system."[2] An excellent review of this

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[1] *Dietetic and Hygienic Gazette*, March, 1892.

[2] Article by Professor Erb, of Heidelberg, on "Diseases of the Nervous System," in "Ziemssen's Cyclopædia."

subject is contained in a lecture by Prof. Charles L. Dana, M.D., of New York, delivered before the Post-graduate College of that city.[1]

The various forms used by the neurologist are:—

1. General hydrotherapy, tonic hydrotherapy, sedative hydrotherapy, and indifferent baths for mechanical purposes.

2. Local hydrotherapy.

Tonic Hydrotherapy.—For purposes of stimulating nutrition and increasing vasomotor tone we employ cold plunges, the rain-bath or shower, the jet, cold sponging, cold sitz-bath, cold sheets, local applications of ice or cold compresses, or cold rubbing, ice-bags, brine-baths, brief cold packs, and sea-bathing. The technique of these is as follows:—

The Cold Plunge.—The bath is filled with water, at from 60° to 70° F. The patient steps in, immerses his body, and at once jumps out and rubs himself vigorously, or is rubbed by attendants, until reaction occurs.

The rain-, jet-, shower-, or needle- bath requires a form of apparatus which delivers the water in fine jets, either vertically or laterally, against the body. The force of the water is an important feature, and both it and the temperature should be properly regulated. In the rain-bath the patient stands in a tub containing some warm water, and the shower is directed upon successive portions of his body. The water may be at first moderately warm and gradually made cold, or it may be cold from the beginning. Where it is desirable to give a shock to the peripheral nerves the latter is preferable, or there may be a succession of showers, alternating hot and cold. Rain-baths should not continue beyond one or two minutes. A solid jet of cool water may be thrown or allowed to fall with force upon the back of the patient, either from a tap or a hose. In the latter case the jet may be thrown from a distance of several feet.

Cold sitz-baths are taken, at a temperature of 70° to 80° F., from twenty to thirty minutes. The **cold sheet**, or **drip-sheet**, is used by wringing a cotton sheet out in cold water, and wrapping it suddenly about the standing patient, who is then vigorously rubbed.

Ice-bags may be kept in contact with the spine, in the lower cervical or upper dorsal regions, for one or two hours, once, or several times, daily.

The half-bath and wash-off consists of a tub partly filled with water at a temperature of 65° to 80° F. The water only half covers the reclining body. While lying in it the patient is vigorously rubbed. A cold cloth may be laid on the head. After five or twenty minutes, affusions of colder water are poured over the shoulders and along the spine.

Brine-baths contain about 2 per cent. of salt (sodium chloride). They are given, at a temperature of 100° F., from twenty to thirty minutes daily; or four baths of 70° F. may be given for five or ten minutes, the patient exercising himself or being rubbed in the meanwhile. The baths at Nauheim, which have come into notice in connection with Dr. Schott's method of treating heart disease, are a form of brine-baths. Grainger Stewart states that similar results may be obtained at home by the use of baths and systematic exercises. The baths can be artificially prepared by adding 1 $^{3}/_{4}$ kg. of salt and 250 grammes of calcium chloride to 250 litres of water at a temperature of 28° to 35° C., the strength of the brine being gradually

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[1] *The Dietetic Gazette*, Dec., 1891, p. 237.

increased. After twenty of these baths, then a Sprudel or effervescing bath is given by adding effervescent salt to water. These baths are very invigorating.

The physiological effects of these different forms of hydrotherapy should be kept in mind. Cold applications produce a local contraction of the blood-vessels, followed by dilatation. There is usually increased tissue-metamorphosis, increased secretion of urine, increased absorption of oxygen, and increased excretion of carbonic acid. In non-febrile persons cold applications abstract some heat, but they also stimulate the heat-producing centres, so that the total effect is to increase the heat of the body. Only very cold baths lessen heat-production as well as excretion of carbon dioxide.

Cold baths at first accelerate and then tend to retard pulse and respiration. Cutaneous sensibility is at first increased. After a cold bath there is a sense of exhilaration and increased muscular power, provided the bath be not too cold or too long continued. The duration necessary to produce a reaction varies with different people, and some weak and sensitive patients never can be made to react. Cold baths, systematically taken, furnish a kind of vasomotor gymnastics. The neuro-mechanism controlling the blood-vessels becomes more supple and the tendency to local congestion of the viscera and mucous membranes is prevented.

The shower and jet furnish the most valuable means of securing tonic effects in nervous disorders. These are not used with cold water alone. The temperature may be gradually changed from 95 degrees or more down to 60 degrees or less, or the hot and cold may alternate. In this way, says Dana, tonic effects can be obtained even with very feeble persons.

Sedative Hydrotherapy in Nervous Disorders.—The sedative baths are the lukewarm bath, the wet pack, Turkish and Russian baths, the hot sitz-bath, pedal baths, compresses and fomentations, and hot-water bags. The following is the technique:—

The lukewarm baths are usually at a temperature of 95 to 98 degrees, and are given from ten minutes to half an hour, daily. If a slight tonic effect is desired also, the patient should receive an affusion afterward, basins of cold water at 60 or 70 degrees being poured over his shoulders. Medicaments, such as salt or pine-needle extract, may be added to the bath with advantage.

The wet pack: A large, thick blanket is spread upon the bed, and over this a linen sheet, wrung out of cold water (40 to 60 degrees). The nude patient lies upon this, and the sheet is then smoothly wrapped about him, the head and feet not being included. The sheet is carried between the legs and made to lie evenly in contact with the body. Then the blankets are folded over him, and other blankets may be piled upon these. Sometimes it is well to place hot-water bottles at the feet and a cool compress on the head. The patient lies in this pack from thirty to forty-five minutes, and is then rubbed off. A cool affusion may be given first. To increase diaphoresis some hot infusion may be administered during the time the patient is in the pack.

Turkish and *Russian baths*, or hot-air and steam-baths, as given in establishments devoted to the purpose, should have professional supervision, and the temperature, ventilation, duration, and after-treatment, by jet, shower, or plunge, carefully adapted to the individual case. A shower or cold affusion to the lower spine is an excellent stimulant to the kidneys.

In a *hot sitz-bath* the patient sits in water at a temperature of 100° to 125° F. for twenty or thirty minutes. Salt or mustard may be added. This is an excellent sedative in dysmenorrhœa; or *hot compresses*, consisting of flannels wrung out of hot water and covered with dry flannels and a rubber cloth, may be substituted in local pains and inflammations. The hot compress is often effective, when applied in this way over the abdomen, for the relief of insomnia. *Hot sprays and douches* are used for similar purposes. The hot spinal bag and hot-water bags for the feet should not be applied at a temperature of over 120 degrees, and should be enveloped in flannel and not placed in contact with the skin.

Warm baths increase heat-radiation and heat-conduction, and thus lower bodily temperature; the warm, moist pack, followed by sponging with tepid water, is the most convenient method of applying the water. On the contrary, the bodily heat may be raised in the pack by applying hot-water bags to the surface and adding blankets. "Warm baths increase the circulation of the skin, lessen cutaneous sensibility, withdraw blood from the central organs, increase the exhalation of carbon dioxide, but lessen respiratory activity, on the whole. Nitrogenous metabolism is increased from 2 to 3 per cent., and more urea is excreted. Pulse and respirations are increased. Nervous excitement is lessened, and the general effect is to cause sedation and abating of languor."[1]

The wet pack is a most useful sedative in **neurasthenia** and **insomnia**, and may take the place of medicinal sedatives, like the bromides. It should be given three or four times weekly or for a short time daily. The lukewarm bath ranks next in its sedative efficacy. Dr. Dana also points out that applications of water to the feet and abdomen especially affect the intracranial circulation, while those given to the thigh and wrists affect the pulmonary circulation, in each case cold causing congestion, and heat anæmia, of the distant parts. (If this be a physiological fact it would oppose the method of Dr. Porcher, given upon a preceding page, for the reduction of bodily temperature in typhoid fever.) Cold to the spine is believed to cause, at first, constriction, and, later, dilatation of the thoracic, abdominal, and pelvic viscera; heat has the opposite effect. Hence, cold applications are used to relieve **cold feet** and also anæmic conditions of the viscera.

In **neurasthenia** Dr. Dana recommends wet packs and half-baths, followed by shower, jet, or plunge. For weak, sensitive, and anæmic women he prescribes, first, dry hot packs for a week, then wet packs, and, finally, the drip-sheet or shower-bath.

In **epilepsy** dry and wet packs may be given; but the best method for a fairly-robust person is that originally described by Fleury. This consists in giving simultaneously the rain, shower, and the jet. The patient, standing in the shower, receives a jet of water on the posterior surface of the body for fifteen seconds; then the jet alone for fifteen seconds; finally, the jet alone on the anterior surface of the body for thirty seconds.

In **hysteria** the rain-shower and the jet are usually most efficacious.

In **locomotor ataxia** lukewarm baths, with pine-needle extract, or half-baths, with affusions and gentle massage, are indicated.

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[1] Dr. Dana, *loc. cit.*, p. 238.

In **peripheral pains** from neuritis and neuralgia the continuous application of ice-bags is often efficacious; and hot sand-bags or water-bags are sometimes applied continuously to the spine for one or two hours, with the purpose of increasing the circulatory activity of the cord.

Cold applications to the spinal column are resorted to with benefit in **chorea** and other spasmodic disorders, such as **persistent vomiting, hydrophobia,** etc. The ice-bag to the scalp is of the highest service in **cerebral meningitis** and **cerebritis,** whether primary or secondary; and it relieves the **headache** and **delirium** in the specific fevers.

In two cases of tetanus accompanied by high temperature Rivière obtained good results from the use of cold baths, which reduced both the fever and spasms and the patients recovered. Opium and chloral had failed in each case to produce any decided amelioration.

The Physiological Action of Carbonic Acid Baths.—L. Fellner writes in the *Berl. klin. Woch.*, June 12th, 1905, on the subject of carbonic-acid baths. He states that in recent times the method of action of the gas in the bath has been more exactly watched, and that, on the one hand, one finds a support of the theory that there is a resorption of CO_2, indicated by an increase of this gas in the breath without any alteration of the quantity of oxygen; and, on the other hand, the type of the stimulus on the skin has been more closely studied. The thermic indifference point of carbonic-acid gas lies much lower than that of the air, and if one takes a bath of 28° C. (that is, 82.4° F.), the water feels cold, but the CO_2 gas bubbles, which separate themselves from the water, exercise a warm stimulation. The two stimuli do not alternate, but exist side by side at numerous different points. CO_2 acts both on the sensory and the motor nerves in the skin. The subjective and objective appearances of such a bath are as follows: After a few minutes one feels a tingling and a peculiar sense of warmth. This sensation increases to one of actual heat, and is most intensely felt in the perineum and around the genitals. These localizations soon break out into a sweat. The skin becomes reddened, and this may last for some time after the end of the bath. Hæmorrhoids generally swell and may bleed profusely. Sexual desires are enhanced. Metrorrhagia sometimes follows a CO_2 bath, and menstruation may appear even when amenorrhœa has existed before. The pulse first loses from four to six beats in the minute, and later quickens, so that after being in the bath for from three-quarters to one hour, the pulse has gained some four to eight beats. When the bath lasts longer than half an hour, the respiration quickens up to eight additional breaths. Feelings of congestion in the head, with sweating, take place. In conclusion he gives the following as a list of diseases which may be treated by the carbon dioxide bath: Those of the nervous system, anæsthesia, hyperæsthesia, neuralgia, and peripheral paralysis of rheumatic, traumatic, and toxic nature; next, functional disturbances of the sexual organs, amenorrhœa, dysmenorrhœa, impotence, and absence of desire. As contraindications, he mentions tendency to bleeding, chronic cardiac disease and chronic lung diseases, and irritability of the respiratory passages.

MINERAL SPRINGS.

The subject of mineral springs has relations of the most intimate kind with balneology and also with climatology, and naturally comes up for con-

sideration in close connection with the preceding section, in which the therapeutic applications of water were dwelt upon. At the very beginning it is proper to direct attention to the fact that the distinction between water and medicinal water is not absolute, but simply one of degree. Pure water only exists in the laboratory; in nature water is always, to a greater or less degree, contaminated with various soluble substances, which it dissolves from the earth's crust or absorbs from the atmosphere. The degree of contamination or impregnation depends upon certain circumstances which are largely of a local character, the springs of one neighborhood containing mineral and other ingredients, which are constantly present and characterize them, so as to distinguish and make them different from other springs, either of the same or of a distant locality. Therefore, degrees of purity are recognized, while absolute purity is not expected; and where the mineral contamination is sufficiently great to make the water produce therapeutic effects, we can divide the waters into classes in accordance with such effects. It is a matter of observation that springs and streams of water, in addition to the natural contamination, may contain, by accident, or design, other constituents, which are called pathogenic organisms, or disease-germs, owing to their effects upon the general health of those using such water. These come under the general head of pollution. Thus, organic refuse, excreta of animals or human beings, sewage and waste from manufactories, etc., pollute a water-supply, and are a frequent source of epidemics. With these pathogenic forms of contamination the present article has nothing to do further than to give a mere reminder of a lurking danger which may unexpectedly be encountered at health resorts and, with this very important exception, among the most sanitary surroundings. As every intelligent person, and especially every practicing physician, should be able to pronounce upon the presence or absence of suspected impurities, and as physicians are often called upon for an opinion as regards the wholesomeness of water, the following tests may enable him to come to a decision. The clearness, transparency, and general appearance of the water, as compared with a sample of distilled water. The odor that it may have is developed by slightly heating some in a small flask and smelling it; the odor may or may not indicate the presence of deleterious substances. Color and turbidity may depend upon vegetable or mineral impurities which are not necessarily prejudicial to health. Should these be absent it must not be at once decided that, because the water is clear, transparent, and odorless, it is wholesome; on the contrary, the most attractive-looking water may contain dangerous pollution, and be entirely unfit for use. The total solids of a good drinking-water should not exceed 25 to 30 parts in 10,000, the character of the solids of course, affecting the results upon health. The total solids are determined by evaporating a certain quantity of water to dryness and weighing the residue. This may be subsequently subjected to chemical examination, if desired to have a complete analysis of the water. Any gases which may come off from the water should be collected, measured, and identified. Qualitative tests for organic matter with potassium-permanganate solution, and for chlorides by silver nitrate, for nitrates with pyrogallol, and for ammonia by Nessler's reagent are usually resorted to. If the permanganate be decolorized after standing a few hours, it indicates presence of organic matter, but not necessarily of animal origin; it may be vegetable and harmless. If a solution of silver nitrate causes an abundant precipitate of chlo-

rides, this may be due also to mineral contamination, as well as to animal excreta. The determination of nitrites and nitrates is of more importance, since they lead to the suspicion of sewage contamination. "They are the resultants of oxidation of nitrogenous organic matter, and, although water containing them is not necessarily dangerous, their presence should render a thorough examination of the source of supply imperative." The pyrogallol test is applied as follows: Put 2 cubic centimetres of pure sulphuric acid in a small test-tube and add 1 cubic centimetre of water to be tested. To this mixture is added 1 drop of a solution of pyrogallol (65 centigrammes in 30 cubic centimetres of distilled water, acidulated with 2 drops of sulphuric acid). The water becomes colored a dark amethyst or wine-brown if the salts are present. The depth of color indicates approximately the amount of the impurity. A very delicate test for nitrous acid or nitrites is that with potassium iodide and starch. Three hundred and fifty to 600 cubic centimetres of water, in a flask, are acidulated with a few drops of dilute sulphuric acid, and a little solution of iodide of potassium added. About 2 grammes of freshly prepared starch are added, and the mixture shaken. If nitrous acid be present the iodide is decomposed, setting free the iodine, which combines with the starch, causing a blue color.[1] A new method of testing drinking-water was devised by Prof. H. Erdmann, of Halle, by the use of 1-8-amidonaphtol-4-6-disulphonic acid, which has the peculiarity of rapidly combining with diazo compounds in acid solutions and forming mono-azo coloring substances. This forms a test for nitrous acid and nitrites, which, if present in decided quantity, indicate dangerous organic contamination of the water. This test is now supplied in (1) a fluid form and (2) $^1/_2$ Gm. (or gr. viiss) tablets, under the name of **Helthin**, by J. F. Schwarzlose Löhne, Berlin, and Schering & Glatz, importers, New York.

Bacteriological tests are now made by all experts in water analysis, and such determinations are absolutely necessary in order to decide positively upon the potable quality of any water-supply. A rough bacteriological test can be made by placing a sample of the water in a clean flask and filling the neck with absorbent cotton in place of a cork. The flask is now placed in a warm situation (say, at a temperature of 90 to 100 degrees) for ten or twelve hours, and then examined. If it become cloudy and develop a putrid smell, it should be regarded as unwholesome, and some source of pollution suspected.

The mineral poisons, especially the common metallic forms,—lead, copper, zinc,—are easily recognized by the hydrogen-sulphide test, and arsenic by Marsh's test. In making the former test about half a pint of the water is placed in a tall glass and acidulated with hydrochloric acid. To this an aqueous solution of hydrogen sulphide is added, and if, upon looking downward through the column of water, a brownish or blackish coloration or precipitate is seen, either lead or copper may be present. The precipitate is collected and dissolved in hot, dilute nitric acid. To this a solution of potassium bichromate is added, and if a yellow precipitate is thrown down which is soluble in caustic potash the metallic contamination is lead. If the precipitate thrown down by the hydrogen sulphide is dissolved as above,

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[1] George H. Rohé, "Text-book of Hygiene," p. 74, Philadelphia, 1890.

and ammonia added, the appearance of a blue color will indicate the presence of copper. To detect zinc the hydrogen-sulphide precipitate is treated with caustic soda, again filtered, and hydrogen sulphide added to the filtering liquid. A white precipitate indicates the presence of zinc. The following summary is given of the inferences to be drawn from these tests by Parkes[1]:—

If chlorine be present in considerable quantity, it either comes from strata containing sodium or calcium chloride, from impregnation of sea-water, or from admixture of liquid excreta of men and animals. In the first place, the water is often alkaline, from sodium carbonate; there is an absence, or nearly so, of oxidized organic matters, as indicated by nitric and nitrous acids and ammonia, and of organic matter; there is often much sulphuric acid. If it be from calcium chloride, there is a large precipitate, with ammonium oxalate, after boiling. If the chlorine be from impregnation with sea-water, it is often in very large quantity; there is much magnesia, and little evidence of oxidized products from organic matters. If from sewage, the chlorine is marked, and there is coincident evidence of nitric and nitrous acids and ammonia, and, if the contamination be recent, of oxidizable organic matters.

"Ammonia is almost always present in very small quantity; but if it be in large-enough amount to be detected without distillation, it is suspicious. If nitrate, etc., be also present, it is likely to be from animal substances, excreta, etc. Nitrates and nitrites indicate previously-existing organic matters, probably animal, but nitrates may also originate from vegetable matter, although this is probably less usual. If nitrates largely exist, it is generally supposed that the contamination is recent; the coincidence of easily-oxidized organic matters of ammonia and of chlorine, in some quantity, would be in favor of an animal origin. If a water give the test of nitric acid, but not of nitrous acid, and very little ammonia, either potassium, sodium, or calcium nitrate is present, derived from soil impregnated with animal substances at some anterior date. If nitrites are present at first, and after a few days disappear, this arises from continued oxidation into nitrates; if nitrates disappear, it seems probable this is caused by the action of bacteria or other low forms of life. Sometimes, in such a case, nitrites may be formed from the nitrates. Lime, in large quantity, indicates calcium carbonate, if boiling removes the lime; sulphate, or chloride, or nitrate, if boiling has little effect. Testing for calcium carbonate is important, in connection with purification with alum. Sulphuric acid, in large quantity, with little lime, indicates sodium sulphate, and usually much sodium chloride and carbonate are present, and in evaporation the water is alkaline. Large evidence of nitric acid, with little evidence of organic matter, indicates old contamination; if the organic matter be large, and especially if there be nitrous acid, as well as nitric, present, the impregnation is recent." Finally, the microscope will often give valuable assistance by examination of the sediment. De Chaumont divides waters into (1) pure water, (2) usable water, (3) suspicious water, and (4) impure water, with the following characters:—

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[1] Parkes's "Hygiene," vol. i, p. 79.

Physical Characters.	*Microscopical Characters.*
1. Colorless, or bluish tint; transparent, sparkling, and well aërated; no sediment visible to the naked eye; no smell; taste palatable.	1. Mineral matter; vegetable forms with endochrome; large animal forms; no organic *débris*.
2. Colorless or slightly greenish tint; transparent, sparkling and well aërated; no suspended matter, or else easily separated by coarse filtration or subsidence; no smell; taste palatable.	2. Same as No. 1.
3. Yellow or strong green color; turbid; suspended matter considerable; no smell, but any marked taste.	3. Vegetable and animal forms, more or less pale and colorless; organic *débris*; fibres of clothing, or other evidences of house-refuse.
4. Color yellow or brown; turbid, and not easily purified by coarse filtration; large amount of suspended matter; any marked smell or taste.	4. Bacteria of any kind; fungi; numerous vegetable and animal forms of low types; epithelia, or other animal structures; evidences of sewage; ova of parasites, etc.

The "hardness" of water is due to the presence of earthy carbonates or sulphates, or both. The former constitutes "removable hardness," because by boiling the carbon dioxide is driven off, and the base (calcium or magnesium oxide) is precipitated upon the bottom and sides of the vessel. The presence of earthy sulphates causes "permanent hardness," and the sum of the two, if present in any given specimen of water examined, constitutes the "total hardness." The degree of hardness is determined by the soap-test. The drinking of hard water is not necessarily injurious, although, to persons unaccustomed to its use, it may cause looseness of the bowels, or even dysenteric discharges. It has also been credited with causing stone in the bladder and goitre, perhaps without sufficient proof. Hard water is wasteful of soap, and in cooking vegetables does not soften the more solid portions; in making tea and coffee there is a loss of active principle, so that larger quantities are required of these materials.

Physiological Effects.—The effects of drinking natural waters may be divided into two groups: (1) those due simply to an increased supply of water to the organism; (2) those which may be ascribed directly to the mineral or other ingredients which may be present. Keeping in mind the bulk of fluid which is swallowed during a "course" of mineral waters, it is evident that the effects of the water itself must be taken into consideration.

Water is necessary both for the digestion and the assimilation of food. In excessive quantity it dilutes the digestive fluids and interferes with absorption. In the conversion of sugar, if there is an insufficient amount of water, no fermentation will take place; if there is a large excess, instead of vinous, acetous fermentation will take place. Drinking habitually an excess of water at meals often aggravates dyspepsia, and may produce flatulence, and what Chomel termed "indigestion of fluids." The drinking of a glass of water, on first rising in the morning, clears the stomach of mucus and has a laxative effect. Small quantities of warm water, half an hour before meals, increase appetite and digestion. A large quantity of fluid in the stomach favors vomiting, and, in cases where an emetic is given, swal-

lowing a pint of warm water will greatly assist its action. The action of water in the intestines is similar to that in the stomach, and a too free indulgence in fluids often causes or keeps up a diarrhœa, as it increases the water, but not the solids, of the fæces. Water passes readily into the blood, especially after privation or hæmorrhage; in the latter case, the too rapid ingestion of water may have an injurious effect upon the red blood-corpuscles, causing their destruction by osmosis. The excess of water passes off by all channels of excretion, but it is principally noticed in the increase of the volume of urine. Not only is the water increased, but the excretion of urea, phosphoric and sulphuric acids, and sodium chloride is augmented, the latter only temporarily, but the former permanently. From this it has been inferred that water leads to augmented disintegration of tissues containing nitrogen and sulphur. But, as pointed out by Ringer, "simultaneously with the rapid disintegration a corresponding increase of assimilation takes place in the same tissues, whence it happens that water, taken under certain precautions, may increase both construction and destruction of tissue, and so act as a true tonic, improving the vigor of body and mind. . . . The effects of water-drinking vary in different persons. The disintegration is greatest in weakly persons, on whom this process may produce almost a febrile state. Disintegration is greater in children than in adults, and greater, perhaps, in women than in men. A high temperature of the water, or of the external air, increases disintegration. Bodily exercise produces the same effect." (Parkes.)

It is a well-known fact that there are other restorative agencies at work at medical springs besides drinking the waters. The sanitary surroundings, fresh air, the tonic effects of change of air and scene, the physical and moral advantages of the regulated life, and systematized rest and exercise under medical direction all assist in producing the effects which follow a visit to the "Springs." This is especially seen on the continent of Europe at Carlsbad, Vichy, Homburg, Ems, Kissingen, Baden-Baden, and numerous other German and French health resorts.

The mineral constituents of medicinal waters enable us to identify and classify them. They are usually divided into the chalybeate, or ferruginous; the acidulous, or carbonated; the alkaline; the saline; the sulphureted, or hepatic waters; chemically indifferent, and unclassified waters.

The **chalybeate waters** contain a small quantity of iron, which is in solution when fresh, but after bottling tends to precipitate in the form of oxide. They sometimes contain, also, a minute quantity of arsenous acid. They are divided into two classes: first, those which contain carbon dioxide, and where the iron is in the form of a carbonate; and, secondly, those in which the iron is in the form of a sulphate. In **anæmia, chlorosis, struma, incipient phthisis**, and other conditions of **debility** they are highly useful, but should be avoided by the plethoric and by those who are subject to headache after taking iron.

The **acidulous waters** contain free carbon dioxide, and are sparkling and agreeable, but frequently contain in solution calcium, sodium, and magnesium carbonates. In rheumatism, lithæmia, and dyspepsia the acidulous waters are useful, especially when taken at the springs. These waters vary greatly in the proportion of their solid constituents, and thus different waters of this class also possess properties which would place them in some other group, with which they might be classed with propriety.

Alkaline waters contain, besides carbon dioxide, an excess of sodium carbonate and other alkaline substances, and also chlorides and sulphates. An example of this class is Vichy water. In the purest alkaline waters there are scarcely any solid ingredients except the carbonates of the alkalies. They are frequently met with as thermal as well as cold springs.

Where there is a marked excess of sulphates and carbonates of the alkaline earths, which are held in solution by an excess of carbonic acid, the water is known as **calcareous,** or **earthy,** water. Calcium sulphate is the particular salt present upon which the properties of these waters commonly depend, usually associated with calcium carbonate. Such waters are "hard." Calcium phosphate is also sometimes found in calcareous waters, and is a valuable constituent.

These waters are useful in the treatment of constipation, sluggishness of digestion, and deficiency of secretion, their purgative effects leading them to be universally used. Those containing magnesium and sodium sulphate are the best known, as Congress Spring, Saratoga; Cheltenham, and Friedrichshall. Wiesbaden and Baden-Baden contain chlorides; Homburg and Kissingen are slightly acid and contain traces of iodine and of bromine; Carlsbad is an alkaline spring, and contains a small quantity of lithia; Vichy, Ems, Apollinaris, and Hunyadi Janos contain the alkaline carbonates.

In the Formulary of the American Pharmaceutical Association are given the formulæ for making artificial Carlsbad, Kissingen, and Vichy salts (sal Carolinum factitium, sal Kissengense factitium, and sal Vichyanum factitium). These are also combined with effervescing salt, so as to produce pulvis salis Carolini factitii effervescens, pulvis salis Kissengensis factitii effervescens, and pulvis salis Vichyani factitii effervescens, and also pulvis salis Vichyani factitii effervescens cum lithio. In many cases these artificial compounds, which are closely modeled upon the natural constituents of the waters, form very acceptable substitutes for the original. In the treatment of obesity Dr. William T. Cathell has had very good results from the use of fresh Vichy and Kissingen water, drunk upon alternate days. When they cannot be obtained fresh he prefers the artificial effervescent salts. He orders a large glass of the waters to be taken, twenty or thirty minutes after each of the three principal meals of the days. If the reduction in weight by this means is not sufficient (two or three pounds per week) he recommends the addition of a little lemon-juice to each glass of Kissingen, and 1 teaspoonful of aromatic spirit of ammonia to each glass of Vichy. He advises a moderately-restricted diet.

Saline waters are solutions of halogen compounds of the alkalies, commonly distinguished by the presence of a large amount of sodium chloride. They also comprise solutions of calcium, potassium, lithium, and aluminum chlorides, and may contain traces of bromine or iodine.

Sulphureted, or **hepatic, waters** are recognized by their odor of hydrogen sulphide, the gas being derived from the oxidation of iron pyrites in contact with water. The sulphides of sodium, calcium, magnesium, and potassium are sometimes present in these waters, singly or together, but always in very minute proportions. The hydrogen sulphide may vary from a mere trace to forty-two cubic centimetres in the litre. These waters are widely distributed, cold or thermal in various degrees. (A. N. Bell.)[1]

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[1] "Mineral Springs of the United States," *Journal of Balneology*, May, 1892.

Argon and helium, gaseous substances, discovered by Lord Rayleigh and Professor Ramsay as constituents of the atmospheric air, have been detected in the sulphureted waters of the Griffon Spring, near Cauterets in the Pyrenees, by Professors Bouchard and Trovst of Paris, and also in the thermal springs of Wildbad. It has been demonstrated, also, that mineral springs contain radio-active substances, some to a very marked degree. This may explain the well-established fact that natural waters are more efficient in the treatment of disease than artificial substitutes from the laboratory.

In the United States there are large numbers of medicinal springs, and within the last fifty years there has accumulated a fund of information upon this subject, which only needs to be systematized and published in order to enable our own resources to be appreciated by American physicians. In many cases patients are sent to the older health resorts in Europe who could be as well treated here and saved the discomforts of ocean-voyages. Much credit is due to Dr. A. N. Bell for disseminating valuable information in the journal of which he is the editor, *The Sanitarian*, and also for the valuable work, which he published some years ago in Wood's Library, on "Climatology and Mineral Waters of the United States."[1]

Dr. Bell classifies our native springs as follows:—

ALKALINE.
- Adams, California.
- Albury, Vermont.
- Alum, Virginia.
- Berkshire, Vermont.
- Blount, Alabama.
- Borax, California.
- Cañon City, Colorado.
- Carlisle, Colorado.
- Congress, California.
- Elgin, Vermont.
- Fry's Soda, California.
- Highgate, Vermont.
- Highland, California.
- Lower Soda, California.
- Manitou, Colorado.
- Middletown, Vermont.
- Milford, New Hampshire.
- Napa Soda, California.
- Newbury, Vermont.
- Perry, Illinois.
- Ravenden, Arkansas.
- Rocky Mountain, Colorado.
- Seltzer, California.
- Sheldon, Vermont.
- South Park, Colorado.
- Summit Soda, California.
- Vichy, California.
- Wilholt Soda, California.

CALCIC.
- Bethesda, Wisconsin.
- Birch-Dale, Vermont.
- Butterworth, Michigan.
- Clarendon, Vermont.
- Eaton Rapids, Michigan.
- Gettysburg, Pennsylvania.
- Hubbardstown, Michigan.
- Silurian, Wisconsin.

CHALYBEATE.
- Abbeville, South Carolina.
- Bedford, Pennsylvania.
- Blossburg, Pennsylvania.
- Cooper's Well, Mississippi.
- Estill, Kentucky.
- Fayette, Pennsylvania.
- Gordon's, Georgia.
- Greencastle, Indiana.
- Kittrell's, North Carolina.
- Madison, Georgia.
- Manley, North Carolina.
- Milford, New Hampshire.
- Montvale, Tennessee.
- Owosso, Michigan.
- Rowlands, Georgia.
- Schooley's Mountain, New Jersey.
- Schuyler County, Illinois.
- Sparta, Wisconsin.
- Versailles, Indiana.

PURGATIVE SALINE.
- Blue Lick, Kentucky.
- Crab Orchard, Kentucky.
- Elgin, Vermont.
- Esculapian, Kentucky.

[1] New York: William Wood & Co., 1885.

PURGATIVE SALINE *(continued)*.
Harrodsburg, Kentucky.
Midland, Michigan.
Pagosa, Colorado.

SALINE.
Fruit-Port Well, Michigan.
Grand Haven, Michigan.
Louisville Artesian, Kentucky.
Michigan Congress, Michigan.
Mt. Clemens, Michigan.
Ocean, Alabama.
Salt, Virginia.
Spring-Lake Well, Michigan.
St. Louis, Missouri.

SULPHUROUS.
Alpena, Michigan.
Balston, New York.
Bladon, Florida.
Blue Lick, Kentucky.
Carlisle, Pennsylvania.
De Soto, Louisiana.
Dremion, Kentucky.
French Lick, Indiana.
Glenn's, South Carolina.
Highgate, Vermont.
Indian, Georgia.
Indian, Indiana.
Lodi Artesian, Indiana.
Manley, North Carolina.
Minnequa, Pennsylvania.
Montesano, Missouri.
Olympian, Kentucky.
Portea Springs, Colorado.
Salt Sulphur, Virginia.
Saratoga, New York.
Sharon, New York.
Sheldon, Vermont.
Shocco, North Carolina.
St. Helena White Sulphur, California.
St. Louis, Missouri.
Sweet, Missouri.
Valhemosa, Alabama.
West Baden, Indiana.
White Sulphur, Louisiana.
White Sulphur, Montana.
White Sulphur, Virginia.

UNCLASSIFIED.
Alum, Virginia.
Birch-Dale, New Hampshire
Borax, California.
Climax, Missouri.
Eureka, Arkansas.
Fairview, Texas.
Greeneleone, Florida.
Geyser Spa, California
Geysers, the American, Wyoming.
Iodide and Bromide, Missouri.
Piedemont, Texas.
Sheldon, Vermont.
Stafford, Connecticut.
Summit, Maine.

THERMAL SPRINGS.
Aqua Caliente, New Mexico.
Arrow-head, California.
Buncombe County, North Carolina.
Calistoga, California.
Chalk Creek Hot, Colorado.
Charleston Artesian, South Carolina.
Des Cehutes Hot, Oregon.
Harbines, California.
Hot Springs, Arkansas.
Idaho Hot, Colorado.
Merriweather, Georgia.
Middle Park Hot, Colorado.
Ojo Caliente, New Mexico.
Paraiso, California.
Passo Robles, California.
Salt Lake, Utah.
Seigler, California.
Skagg's, California.
Volcano, Nebraska.
Warm and Hot, West Virginia.

Some of the above-mentioned springs have won a high reputation, and the water is transported in large quantities to different parts of the country. From what has been said previously, it is evident that the water-cure is largely assisted by the sanitary surroundings. Some of the most remarkable springs in the world exist in the beautiful Yellowstone National Park, where thermal, alkaline, sulphurous, saline, and pure spring waters are found at an altitude of about 8000 feet or more above the level of the sea.

CLIMATOTHERAPY AND CLIMATOLOGY.

Climatology studies the influences exerted upon the atmosphere, and upon individuals, by temperature, humidity pressure, soil, proximity to the sea, lakes, rivers, plains, forests, mountains, light, ozone, and electrical and

other physical conditions. Climatotherapy studies the curative effects of climates and climatic conditions as factors of health. This brings us to the definition of **climate,** by which we designate the characteristic and prevalent characters of a place as regards conditions of atmosphere, its temperature, moisture, purity or contamination, electrical tension and chemical constituents, especially in their physiological relations.

Agreeing with the definition of Hamm and Humboldt, we may accept climate, therefore, as comprising the whole of the meteorological phenomena characterizing the state of the atmosphere at any place, particularly as they affect our organs, or have an influence on animal or vegetable life. The general character must be taken, not basing the conclusion upon the limited observation of a few days, or even years; but a period must be taken which is long enough to furnish the data for composing a type. Equal yearly averages do not signify identical climate. A place where the summer heat and winter cold are extreme has not the same climate as one where the range is relatively small, though the yearly average may be identical. Hence we need, says a recent writer,[1] separate determinations of summer and of winter averages. The combinations of conditions of temperature and moisture may be endless, while the averages of either may be hardly disturbed. These facts make it hard to compare climates, even when they are steady for long periods. In the capricious climates of our temperate latitudes, a just determination and comparison form a baffling task.

Climatic conditions are largely affected by the physical configuration of the earth's surface,—the presence or absence of mountains, forests, lakes, rivers, etc.,—and also by the latitude. In the summer months the sun passes north of the equator, until, at the summer solstice, it, at its zenith, is in the zodiacal sign of Cancer; at the winter solstice the sun is at its zenith in the sign of Capricorn. Two imaginary lines, drawn the one north and the other south of the equator, and parallel with it at a distance of 23° 28′ in each hemisphere, would include the torrid zone, which includes the **north** and **south tropical zones.** Other circles, drawn at a distance of 66° 32′ from the equator, or 23° 28′ from the pole, in each hemisphere, mark the upper limits of the north and south **temperate zones.** The areas included within the polar circle around the poles are known as the **frigid zones.** Heat, from a medical stand-point, is a very important factor in climate. Maximum atmospheric temperatures are met with in the tropics, minimum in the frigid zones. The intermediate zones, which are the largest, present, also, the most favorable conditions for human existence, with a great variety of climates, though, on the whole, moderate in temperature as compared with the polar or equatorial regions. Temperature is affected, also, by altitude. As we descend below the surface of the earth the temperature increases at the rate of 1° F. to every one hundred and twelve feet, and at less than two miles we have the temperature of boiling water, and at thirty miles it is estimated that, at the same ratio, "the heat is sufficiently intense to melt all the rocks and metals contained in the earth's crust and to account for the torrents of molten, fiery lava belched from the craters of raging volcanoes. It is to this internal heat of the earth that hot springs and the warm water of deep artesian wells are due" (Bell). On the other hand, temperature

[1] Dr. W. H. Larrabee, *Popular Science Monthly.*

declines as we ascend above sea-level at a rate of about 1 degree for every four hundred feet of altitude; so that, in the United States, high mountains have their tops in the regions of perpetual snow. At a certain elevation the moisture of the air congeals into snow, and this forms the "snow-line," which, for obvious reasons, is higher at the equator; but it is not uniform, even on the same parallel, owing to local influences. The angle at which the sun's rays impinge upon the surface is one great cause of the diversity of temperature and the succession of climates from the equator to the poles, and irregularities of the surface give rise to various differences of climate in the same latitudes. The number of hours of daily sunshine in a given locality is a feature of great importance in climate. The direction of the prevailing winds, the amount of movement of the air, and the presence of moisture also affect the salubrity of a locality and contribute to give it its therapeutic value. Aqueous vapor in the atmosphere constitutes a moist stratum which retards the process of nocturnal cooling of the whole atmosphere and prevents excessive alternations of temperature between night and day. The atmosphere always contains some moisture at a temperature above 32° F. The temperature of a place exposed to the full rays of the sun is greater than in the shade at every elevation; the difference, according to Dr. Charles Denison, of Colorado, augments with elevation, there being "one degree greater difference between the temperature in the sun and shade for each rise of two hundred and thirty-five feet." This is owed to the fact, above indicated, that the atmosphere is more easily traversed by heat when the amount of moisture is small. At an altitude of four thousand feet and upward the increase of heat in the sun's rays relative to the temperature of the surrounding air becomes a marked feature, insomuch that, at an altitude of from six thousand to ten thousand feet above the level of the sea, the thermometer exposed to the rays of the sun usually registers about one-third higher than when in the shade.

As regards valleys and hills, Dr. A. N. Bell observed that it does not follow, because the hills are higher than the valley, that they are necessarily colder and the valley warmer. The hills enjoy more sunlight and less moisture. The cold air, by reason of its greater density, descends into the valley, and the warm air rises to the top of the hills, except where there is sufficient wind to produce disturbance and intermixture of the higher and lower strata of air, when this exception to the general rule will not occur. This affords a useful hint about selecting a habitation. "The damp and chilly valleys, with their attendant ills, are more frequently chosen as building places than drier, warmer, and healthier hills." Winds are produced by differences of temperature and to changes of atmospheric pressure due to expansion of air under the influence of heat. The direction in which winds blow depends upon the distribution of heat upon the earth's surface and the daily rotation of the earth. Winds always flow from a region of higher pressure to a lower one, with a velocity increasing with the difference and inversely as the distance.

When air contains all the aqueous vapor which it can take up it is said to be at the point of **saturation**, which is also the dew-point, because above this point the moisture is deposited upon surrounding objects, in the form of dew. The higher the temperature of the air, the more moisture it is capable of taking up, in a geometrical ratio with the increase of temperature. The quantity of water in a given volume of air is called the

absolute humidity. The ratio between the actual absolute humidity and the point of saturation indicates the degree of dampness, or **relative humidity.**

The atmosphere of the ocean and sea-shore is often supercharged with moisture from the spray, which it carries even for several miles inland. Winds from the sea are likely to have a high relative humidity. Winds from the poles are cold; those from the equator are warm, as the rule, in each hemisphere. When the temperature of air is rapidly reduced, the absolute humidity may approach the point of saturation, and the excess of water be precipitated as rain or snow. When a warm wind from the sea meets the cool air of a mountain-range, the excess of water is precipitated in the form of rain, and the air has its relative humidity reduced. The result is that a mountain-range parallel with a sea-coast will have a humid atmosphere upon one side and a comparatively dry one upon the other side.

The pressure of the atmosphere at the sea-level is nearly fifteen pounds to the square inch, which is equivalent to a weight of thirty inches of mercury, as demonstrated by Torricelli. The total pressure upon the surface of a man's body of ordinary size is nearly fifteen tons. This enormous pressure is not felt, because it is evenly distributed and also for the reason that the human organism is adapted to it by nature and has become accommodated, or acclimated, to certain altitudes. As the pressure diminishes, at the rate of about one pound for each two thousand feet, one of the factors in the therapeutic effects of high altitudes is probably the alteration of pressure upon the bodily surface and the resulting physical changes in the circulating fluid and the tissues. In mountain-climbing there is experienced a feeling of exhilaration and a lightness which may be due, in part, to the diminished density of the air. At an elevation of from ten thousand to sixteen thousand feet, rapid breathing, dyspnœa, and increased action of the heart occur, with feelings of faintness upon slight exertion; and, if the ascent has been rapid, as in a balloon, blood may pour from the nose and mouth and other mucous orifices of the body. A removal from the level of the sea to an altitude of two or three thousand feet, in the summer-time, which is undertaken for sanitary and physiological reasons by large numbers of the population, is more than simply changing from a polluted atmosphere to a pure one, more than exchanging a humid atmosphere for a dry one, or a hot for a cool one; it is throwing off from the surface of the body a certain proportion of the atmospheric pressure and breathing a somewhat rarefied air, which of itself causes greater inspiratory effort, quickens the circulation, and increases metabolism.

As pointed out by von Petenkofer, Bowditch, and others, the nature of the soil and the drainage and rise and fall of the ground-water have much to do with the healthfulness of a climate. Bodies of water give forth moisture; bodies of sand and dry soil absorb it from the air. Sand being a poor conductor of heat, the sun's rays do not penetrate deeply, and the heat is radiated at night, making the night cold and the days hot, which feature characterizes the desert climate. An alluvial soil (clay or loam) being a better conductor, and usually being covered with vegetation, absorbs heat during the day and does not readily part with it at night, partly on account of the layer of moisture to which attention has already been directed. In consequence of this fact, a modifying effect is exerted upon climate; the temperature does not get so hot during the day and is less cold at night. For-

ests protect the earth's surface from the action of the sun; the temperature of the air of the woods is, therefore, cooler in the day-time, than the surrounding atmosphere, and, as the result of interference with evaporation, contains more moisture. Owing to the fact, in vegetable physiology, of the decomposition of carbon dioxide by the green parts of growing plants, in order to appropriate the carbon, there is a constant evolution of oxygen in the woods. The agitation of the air by the green leaves, especially in the coniferæ, causes some of the oxygen to appear as ozone, the effects of which upon the human body have already been referred to. This agent, which has been called "nature's antiseptic," is, therefore, likely to be met with in the woods, and also upon the sea-shore; but only exceptionally, and to a very slight extent, in large cities. The fact that a forest between a marsh and a city would protect the latter from certain fevers, was known to the ancients. In recent times the marshes around Rome have been redeemed and made habitable by the labors of the Trappists, who set out plantations of eucalyptus-trees, which naturally absorb large amounts of moisture from the soil. Trees have a very decided effect, therefore, upon climate, not only by protecting the soil from the rays of the sun and favoring the healthfulness of a locality, but they also, as oxygen-generators and ozone-producers, as well as carbonic-acid destroyers, play an important part in the preservation of animal life.

Water has an important function in climate. On account of its high specific heat, it abstracts heat from the surrounding air and cools the atmosphere in summer, and in winter it yields up its store of heat slowly, by radiation, and thus modifies the rigors of climate at the sea-shore. The gulf-stream makes northwestern Europe habitable, and the comparatively mild climate of our Northwest coast is attributable to the warm current of the Japan stream, each of which flows like a great river in the ocean, mainly in a northeasterly course. Marshes are caused by water spreading over a portion of ground, on account of the ground being level and porous. Such accumulations of water, with little or no current, afford a favorable breeding ground to the anopheles mosquito, who is the distributor of the plasmodium, which, as shown by Laveran, is the source of malarial poisoning. As these paludal manifestations usually appear in the spring and fall of the year, they are sometimes known as vernal and autumnal fevers; or, from the pathological conditions, they are styled congestive chills, intermittent or remittent fevers, chills and fever.

With regard to the atmospheric electricity and its effects upon climate, very little is known of its relations to health and disease. It is probable that atmospheric ozone may be due to electrical conditions, and that the purity and stimulating qualities of the atmosphere in some localities is due, indirectly at least, to electricity. The frequency of thunder-showers in the mountains undoubtedly contributes to the sanitary qualities of these highly-prized health resorts.

As to the physiological effects of climate upon human beings, very important facts have been established by investigations in the fields of anthropology, ethnology, and vertebrate paleontology. Man is affected by his environment, and the most important factors in the problem are food and climate. Reserving the former for discussion in the section on "Dietetics," we may here devote a few words to the latter in connection with a few fundamental facts in physiology and in pathology. At the same time,

it must be stated that they are, in social relations, very closely connected; because a climate that is unfavorable for human life is also unfavorable for the life of domestic and other animals upon which man depends for subsistence, and is also unfavorable to agriculture, so that insufficient food and a severe climate act in concert to produce physical degradation. A very hot climate, on the other hand, while it favors vegetation, also favors the development of malaria and other piroplasmic poisons, like yellow fever, which not only cause disease, but cause physical degeneration in races which do not become acclimated. The dark-skinned races of men have acquired the ability to live in the tropics with apparent impunity, but the white races do not find the climate propitious, either with reference to individual health or the rearing of their children. In a similar manner, certain families or tribes of men, having for many generations lived in one locality and accustomed to the climate (harmonized with the environment), may find great difficulty in becoming acclimated should they remove into another region having different characters. Major Woodward, Surgeon in the United States Army, has shown that the northern white races cannot become permanently acclimated to the tropics.

Local influences may change so as to bring about a modification of climate. This has been noticed after cutting down groves of trees, and especially after draining alluvial soil. A very good illustration is given by Dr. W. J. Hutchinson of the effects upon the climate of southern California produced by the appearance of Salton Lake. It is claimed that this newformed body of water has increased the humidity of the atmosphere and the rain-fall over a considerable area. The result has been a reduction of the extremely high temperature which prevails in other parts of southern California and a great revival of vegetation.

The effects of climate upon physical conformation is an inviting field of study. The Serranas, a native tribe of Peru, live in the high peaks of the Andes and are short in stature, but have a remarkably well-developed thorax and lungs, being about thirty-six inches around the chest, with a bodily height of seven and four-fifths inches less than the average height of Europeans.[1] The Esquimaux are a short, thick-set, degenerate race, who apparently are so worsted in their struggle with adverse climatic conditions as to extinguish nearly every manifestation of intelligence except those connected with the satisfaction of physical wants. On the other hand, the hot weather of the tropics, on account, largely, of its excessive humidity, is enervating, and debility and anæmia are common results. In temperate zones, however, man attains his highest physical, intellectual, and moral elevation, and these regions furnish explorers, armies and navies, and the pioneers of commerce and civilization who discover and rule less favored races, and penetrate to the ends of the earth and make them tributary to science and the social requirements of the age in which we live. Moreover, the more cultured races, having acquired a knowledge of sanitation and especially of the causes of infection and disease, are able to apply this knowledge for the protection of health. The excessive mortality which formerly prevailed among the English troops in India and the West Indies was attributed by the late Dr. Parkes to unsanitary conditions rather than to the

[1] Quoted by Dr. A. N. Bell from the Official Report of Medical Inspector B. F. Gibbes, U. S. N., on the Medical Topography of the Pacific Coast of South America.

climate itself. Under improved methods of sanitation, especially as regards the purity of the water-supply and cleanliness of habitations, the mortality has been steadily decreasing "until, in some stations in the West Indies (as, for example, Trinidad and Barbadoes), the sickness and mortality among European soldiers are actually less than in home service. In India, a century ago, people spoke with horror of the terrible climate of Bombay and Calcutta; and yet Europeans now live in health and comfort in both cities. In Algeria the French experience is to the same effect." Parkes also directed attention to the greater necessity of sanitary precautions in hot climates. "The temperature and the humidity of the air are highly favorable to decomposition of all kinds; the effluvia from an impure soil and the putrescent changes going on in it are greatly aggravated by heat. The effects of unsanitary evils—which, in a cold climate like Canada, are partly neutralized by the cold—are developed in the West Indies or in tropical India to the greatest degree. In this way a tropical climate is evidently most powerful, and it renders all sanitary precautions tenfold more necessary than in a temperate zone." Dr. Bell coincides with these views, and even in the case of pulmonary consumption, the prevalence of which in certain localities is usually held to afford a rough indication of the influence of climate, he regards it as "a disease which, probably more than any other, depends upon preventable conditions intimately associated with a foul soil or density of population."

The good effects of the most salubrious climates may be overcome and disease develop as the result of neglect of common sanitary duties and violation of physiological laws. The intelligent physician is able to point out the causes of ill health and enable the patient to avoid them. The philosophy of the modern exodus from the large cities to the country, sea-side, and mountains which takes place in the hot months of the year, may be easily understood from what has just been explained. It is the same in the climatic treatment of disease. If pulmonary tuberculosis be due to overcrowding and a polluted atmosphere, the remedy is obvious: the patient should be taken to a place which is not crowded and where the air is pure, and he will be placed under better conditions for his recovery.

Mountain sickness, as pointed out by Dr. S. Edwin Solly, is that physiological disturbance which occurs more or less in all human beings and animals who ascend to a high altitude. It has been proved that the disturbances are due to the diminished oxygen-tension. In consequence of the diminished barometric pressure the molecules of air are more widely separated than at sea-level, and the actual amount of oxygen in each cubic inch of air is lessened. Dr. Solly also has called attention to the physiological effect of altitude upon the blood, when the oxygen-tension diminishes the number of red corpuscles and the percentage of hæmoglobin proportionately increases. At 6000 feet the blood-cells would increase 4,000,000 to 5,000,000 and the hæmoglobin 16 per cent. In an unhealthy person the increase would be even greater.

Classification and Climatotherapy. — No satisfactory classification of climates can be made, and the distinctions made are often conventional and relative. Hot and cold climates, humid and dry climates, marine and inland climates convey certain general ideas to the mind. The climate of elevated plateaus and mountains and the climate of valleys and plains differ to a marked degree, owing to conditions which have been already considered.

The United States, in its wide area, offers a choice of every variety of climate. An ocean climate may be enjoyed at the sea-shore or on islands some distance from the coast. The mountain-ranges of the Appalachian system or of the Rocky Mountains contains numerous health resorts of well-earned reputation. The high table-lands of New Mexico and Arizona are remarkable for their salubrity, while the valleys of California between the Foot Hills and the coast-range of mountains afford spots of remarkable fertility, beauty, and health-giving powers. We have the cold climates of Maine and Minnesota, or the hot ones of the Eastern Atlantic Coast in the Southern States; and in Florida we have a new-world Riviéra upon the gulf-coast, especially around Tarpon Springs.

Change of climate is frequently beneficial in disease, owing to mental and moral conditions, or the psychological effects; on the other hand, it is an act of cruelty to deprive some semihelpless invalids of the comforts that they are accustomed to enjoy and make them suffer the pangs of homesickness, in addition to their physical weakness and disease. Moreover, in speaking, in a general way, of climate in the treatment of disease, it must be remembered that each locality possesses individual peculiarities, such as dryness or dampness of the soil, excess of sun or shade, direction of prevailing winds, the presence of forest-trees or bodies of water, as well as convenience of access and other circumstances not climatic (such as comfortable hotel accommodations, good milk and other food in abundance), which contribute very much toward the availability of any particular resort in any special case. It is of importance, therefore, that physicians should acquaint themselves fully regarding the advantages and disadvantages of health resorts that they recommend for their patients, and it is better to do this by personal inspection, wherever possible. Attention has already been called to the fact that the most salubrious localities may lose all their advantages by neglect of sanitary precautions; for we know that cases of typhoid fever and dysentery, and other forms of ill health, may arise from foul drains or an infected water-supply, even among the best surroundings.

As regards climates from the medical standpoint, a good classification is that of Dr. Hermann Weber,[1] which, with some modifications, is as follows:—

(A) Marine Climates.

I. *Marine Climates with High Degree of Humidity.*

1. Warm and Moist Marine Climates:—
   Illustrations: Madeira, Canary Islands, the Azores, Ceylon, Hawaii, Bahamas, Bermudas, Virgin Islands, Cuba, Jamaica, Barbadoes, Florida, Georgia, South Carolina, Society Islands, Tahiti, Tonga, Fiji Islands, Tristan d'Acunha, St. Helena.

2. Cool and Moist Marine Climates:—
   Island of Bute, Rothesay, Hebrides, Orkney and Shetland Islands, Faroë Islands, Iceland, Bergen, Marstrand, Auckland Islands, Falkland Islands.

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[1] Von Ziemssen's "Hand-book of General Therapeutics," vol. iv, English translation. New York: William Wood & Co., 1895. In connection with this subject, and for information of which want of space prevents proper discussion in this place, the reader is referred to the valuable treatise of Dr. A. N. Bell, of New York, on "Climatology and Mineral Springs of the United States," and also to the more recent work of Dr. Bushrod W. James, entitled "American Resorts, with Notes upon their Climate." Philadelphia: The F. A. Davis Company, 1889.

II. *Marine Climates with Medium Degree of Humidity.*

1. Warm Marine Climates of Medium Humidity:—
   Tangiers, Algiers, Cadiz, San Lucar, Gibraltar, Ajaccio, the Sanguinaires, Palermo, Riviera di Levante, Pegli, Venice, Balkan Peninsula, Corfu, Crimea, Lisbon, Vigo, Santander, Biarritz, New Zealand, Auckland, New Plymouth, Wellington, Nelson, Virginia Beach, Old Point Comfort.
2. Cool Marine Climates of Medium Humidity:—
   (*a*) Winter Resorts:—
   Queenstown, Isle of Wight, Florida, Lakewood (N. J.).
   (*b*) Summer Resorts:—
   North Coast of Cornwall and Devonshire, Wales, Ireland, Brest, North Coast of France, Belgium, Holland, Germany, Tasmania, Coasts of England and Ireland, Newport, Isle of Shoals, Nantucket, Mount Desert, Fire Island.

III. *Marine Climates with Low Degree of Humidity.*

The Western Riviéra, Nice, Monte Carlo, Mentone, Naples, Capri, Ischia, Malta, the Balearic Islands, Smyrna, Athens, South Africa, Australia, New South Wales, Sydney, Victoria, Melbourne, the New Jersey Coast, Long Branch, Atlantic City, Cape May.

(B) Inland Climates.

1. Climates of High Altitudes, or Mountain Climates:—
   Davos-Platz, Davos-Dörfli, Davos-Frauenkirch Wiesen, St. Moritz, European Alpine resorts, German mountain resorts, Northern Italy, Apennines and Maritime Alps, Peruvian Andes, Rocky Mountains, Colorado Springs, Denver, St. Paul, Asheville, South Africa, India, Mexico, Catskills, Alleghenies, Cresson, Green Mountains, White Mountains, Glen Summit, Pocono, Kane, Schooley's Mountain, etc.
2. Climates of Low Levels:—
   Dry and Warm Climates: Africa, New Mexico, California.
   Dry and Cold Climates: Minnesota, Canada.
   Moderately Moist Climates: Rome, Pisa, Pau, New England States, Saratoga, etc.

Choice of Climate for the Treatment or Prevention of Disease.

In determining the correct solution of the question as to the climatic treatment in any given disease, the physician has to solve a complex problem, into which enter the psychical condition of the patient; his financial ability, his capacity to endure the discomforts of travel, and his personal preferences and habits of life, as well as the nature of his disease and the advantages and physiological effects of the proposed place of residence. Patients with seriously damaged lungs, kidneys, or hearts should not be sent to high altitudes; or, if they insist upon making the experiment, they must be allowed to make the change gradually, by resting for several weeks or months at intermediate points. Patients whose vitality is exhausted, and who are evidently doomed to early dissolution, should not be allowed to go to distant health resorts, deprived of the comforts of home, and only to die among strangers. A very sick patient does not enjoy scenery or the incidents of travel, and often actually suffers more from homesickness than from his disease. Phthisical cases in the second or third stage should, as the rule, be kept from a moist climate, whether cool or warm, as the progress of the disease is generally hastened. Invalids cannot endure hardship.

Summer residence in the country is a prudent, sanitary, and prophylactic measure, by rare coincidence having for its support both fashion and medical teaching. Its effects are most demonstrably evident in the younger

members of the family. In some instances, where health is impaired or notably affected by residence in the city, a permanent change of place of living should be advised, if practicable. Pure air, pure water, wholesome food, and a regulated life are the conditions of health and longevity, and, therefore, are factors in the therapeutic problem. A patient cannot live on climate alone, although, in popular discussions of the subject, this is dwelt upon as if it were the only thing to be considered. With this in mind, we will proceed to outline the climatic treatment of some principal diseases:—

Acute diseases, as the rule, should be treated at home, or in the immediate vicinity.

Anæmia and Chlorosis.—Such cases are benefited by life in the open air, where there is abundance of sunshine and the temperature does not forbid physical exercise. The sea-coast, early in the summer, followed by a stay at the mountains later, is advisable, together with out-door amusements and bicycle or horseback exercise. If much debilitated, a preliminary visit to a good hydropathic institution would be of great value in building up the nervous system and increasing hæmatosis. Weber recommends places where the whole day may be spent in the open air without demands being made on the bodily strength. Long sea-voyages are often curative.

Asthma.—Where there is no heart complication and no emphysema, these patients do well at mountain stations, or on inland plateaus. Where there is much bronchial complication, a dry climate should be preferred; where the secretion is scanty, the patient may improve more rapidly among the pine-woods, near the coast. We cannot predict, in any given case of asthma, whether it will be benefited by a marine climate or not; but, as a general rule, especially if there is emphysema present, these cases do better at a moderate elevation inland. Mountain-climbing is useful as a form of respiratory gymnastics, especially in catarrhal complications.

Children and nervous subjects are usually benefited by the sea-shore. Hay-fever patients seek a pure atmosphere, free from dust and pollen. They may find relief either in mountain resorts (Bethlehem, White Mountains, Kane, etc.) or on islands (such as Nantucket).

Bronchial Catarrh.—Chronic bronchial catarrh, with merely increase of secretion and a moderate amount of cough, may be benefited by either a marine atmosphere or by mountain or inland climate. The change of residence of itself is of service, even where there is not much difference in climate, altitude, or temperature. In the declining stage of whooping-cough systematic exercise in the open air is an important part of the treatment; and, as a general rule, in chronic cough, unattended by much pathological change, the best results are obtained from pedestrianism, especially in mountain regions, such as the Catskills.

Blood Disorders.—In morbid conditions of the blood the climatic treatment is a useful adjunct to the ordinary treatment by alteratives, tonics, and chalybeates. Careful regulation of the diet and hygienic management are also required in all cases. Residence at the sea-shore exercises a powerful alterative effect, and, owing to the presence of ozone, it is a decided stimulant to tissue-construction. As anæmia and chlorosis may result from a warm, humid climate, a change to a moderately cool, bracing atmosphere is attended by improvement. A moderate amount of cold, even, will do no harm if the clothing and living-rooms be properly adapted to the temperature; the cold will improve the appetite and favor out-door exercise. In

cases attended by profuse menstruation sea-climates are often injurious, and in early pregnancy abortion may occur at the sea-shore. The favorable effects of altitude upon the number of red blood-cells, and the proportion of hæmoglobin, have already been referred to.

Climacteric disturbances of health are greatly influenced by climatic conditions. Not only at the change of life in women,—at the cessation of menstruation,—but also at puberty do we meet with evidences of disorder, particularly of the nervous system; but the circulation and organs of digestion and assimilation are also affected. There may be delayed development or insufficient evolution of the sexual system and deterioration of the general health. In such cases change of climate, the excitement of change of scene, and pleasure of voyaging are useful adjuncts to the means employed to bring about the normal state. **Premature senility,** either of organs or of the general system, is sometimes mistaken for ordinary disease, and uselessly treated by medicines. Lowering of general activity, easily-produced fatigue, liability to catarrhal attacks, with impaired digestion, are the prominent symptoms of this condition. By a resort to warm, sunny, and dry climates during the winter season and a moderately elevated mountain climate in the summer many of these complaints are overcome or avoided, and in this way life may be prolonged and senile decay deferred.

Consumption.—The climatic treatment of pulmonary phthisis, or consumption, has been the subject of study from the earliest times, and an abundant literature has accumulated upon it, including such valuable recent works as that of J. A. Lindsay or C. T. Williams. It has also received favorable consideration in the writings of Jaccoud, Austin Flint, Charles Denison, Trudeau, and other authorities. No climate can be regarded as possessing a specific effect in arresting phthisis, although some exert a much more favorable influence than others in bringing this about. According to Flint, "Dryness, equability, and purity of the atmosphere are essential elements of a favorable climate," and he further declares that "there is reason to believe that the benefit derived from climatic treatment is often, in a great measure, due to accessory circumstances."[1]

In his address read before the Berlin International Medical Congress Dr. Weber considered the influence of climatic, local, and social conditions on the occurrence and course of pulmonary tuberculosis. As already stated, no climate is entirely exempt from phthisis. He agrees with Hirsch that, if we consider the distribution of phthisis over the world, we must come to the conclusion that the climatic conditions alone, apart from other conditions, especially the social ones, will not afford a sufficient explanation of that distribution. It is necessary to consider the temperature, condition of the soil (dryness or dampness), the elevation above the sea-level, race, effect of colonization, social circumstances, and the industrial pursuits. Phthisis progresses more rapidly in the tropics than in the temperate zones, and he considers that the bacilli are favored in their development by heat and moisture, and also that their products are more toxic under such conditions.

Hygienic regulations are more apt to be obeyed at a health resort than at home. There is also a freedom from the cares of business or the household, combined with associations with new acquaintances, affording diver-

[1] Pepper's "System of Medicine," vol. iii, p. 429.

sion and mental relaxation, which act as nerve-tonics. Very often patients can eat more food when away from home than when at their own table. All these accessory agencies are of value, and contribute to the undoubtedly beneficial effects of change of scene. Cold and damp locations are to be avoided, especially if the patient is thereby compelled to remain in his room. The great object is to select a climate favorable to living in the open air the greater part of the time. In New Mexico it is possible to remain day and night in the air, on account of the dryness of the atmosphere. Distance and convenience of access must be taken into consideration; so that, if the patient becomes homesick or desires to be taken home, it will not be impossible to bring him back without unduly taxing his strength. If the patient be very feeble, it will not be advisable to disturb him with a journey, unless it be merely to the suburbs of the city during hot weather. On the other hand, if the case be in its incipiency and the patient young and his health not much impaired, it may be better for him to emigrate, and remain permanently in some climate that will agree with him. Dr. Flint suggested that, if the patient bear hot weather well and is worse in cold weather, he should go south, at least during the winter; on the contrary, if he is always better in cold weather, he would do wisely in going to a northern resort, such as Denver, Colorado Springs, St. Paul, etc. Some cases have done very well at Newport, but during the summer a stay in the woods is to be preferred to the sea-shore, for reasons already indicated. The Adirondacks have attained a world-wide reputation for the cure of pulmonary diseases, and White Haven, Pa., Lakewood, N. J., and Asheville, N. C., are also famous health stations for the cure of consumption.

Dr. Anderson, of Colorado Springs (6000 feet above the sea), says that patients do not always tolerate this high altitude, and the expected relief is not obtained. In a certain proportion of these cases benefit will follow change to a lower altitude, as 3000 to 4000 feet above sea-level, and residence there until improved and somewhat acclimated. He mentions approvingly the Mesilla Valley of New Mexico, where are found combined the important essentials of a maximum of sunshine and dry air, together with only a moderate elevation.

Open-Air Treatment.—The majority of patients, however, are unable to change from one climate to another, and all such should be advised to live as much as possible in the open air. The early stage of pulmonary tuberculosis, other forms of tuberculosis, neurasthenia, rachitis, chlorosis, and anæmia are susceptible of much benefit from this mode of life. Even in hospitals it has been found beneficial to keep such patients about the grounds or on the verandas, and to have them sleep on balconies.

Exhaustion from Overwork and So-Called Neurasthenia. — These are conditions, in a sense, allied to hypochondriasis and hysteria, and, with these, are benefited by combined balneotherapeutical and climatic methods of treatment.

Indigestion and dyspepsia are closely related to the foregoing, being largely functional and are greatly benefited by change of climate. The same remark holds good for chronic diarrhœa, which can often only be permanently arrested by a sojourn in a dry and equable climate.

Insomnia is relieved by change of residence, either to the mountains or the sea-shore. In nervous erethism, where patients are easily excited, it is of importance to learn the character of the hotel to which they are sent,

inasmuch as their comfort and health depend principally upon freedom from noise and excitement. If music and dancing until after midnight is the rule of the house, their sleep may be more broken than at home. A suitable environment is of as much importance as a proper climate.

Lesions of the Nervous System.—According to Weber, nervous disorders should more often be subjected to treatment by climate than is customary.

Leukæmia is apparently benefited by long cruises in yachts, and Weber advises, in addition, prolonged stay in Egypt or Algiers. In advanced cases little can be expected beyond extending the duration of life. In **malarial toxæmia** mountain regions are curative; damp situations are to be avoided on land, but sea-voyages are useful.

DIET IN DISEASE.

The principles of dietetics, and likewise the physiology of nutrition, apply equally in disease and in health, the only difference being that the power of digestion and assimilation with the secreting and excreting functions are more or less impaired; the food must, therefore, be of a character suitable for assimilation, of nourishing quality, and administered in quantities, and at such intervals, as appear best suited for the case. The aid which properly-selected food can render in the treatment of disease is now generally acknowledged. If, as Abernethy is reported as saying, it be a fact that the cause and cure of most diseases is at the table, the importance in therapeutics of food is no less than drugs. Oliver Wendell Holmes, nearly thirty years ago, in his essay on the "Border-lines of Knowledge in Some Provinces of Medical Science," declared his high appreciation of this subject as follows: "I cannot help believing that medical curative treatment will, by and by, resolve itself, in great measure, into modifications of the food swallowed and breathed, and of the natural stimuli, and that less will be expected from specific and noxious disturbing agents, either alien or assimilable." Dr. Austin Flint, in his posthumous address on the "Medicine of the Future," prepared for the meeting of the British Medical Association in 1886, expressed a similar idea. "It is a pleasant thought that hereafter the practice of medicine may not be so closely interwoven as hitherto in the popular mind with the use of drugs. The time may come when the visits of the physician will not, as a matter of course, involve the co-operation of the pharmacist; when medical prescriptions will be divested of all mystery, and have no force in the way of fortifying the confidence of the patient. The medical profession will have reached an ideal position when the physician, guided by his knowledge of diagnosis, the natural history of diseases, and existing therapeutic resources, may, with neither self-distrust nor the distrust of others, treat an acute disease by hygienic measures without potent medication. When this time comes a system of practice which assumes to substitute medicinal dynamics for the *vis medicatrix naturæ* will have been added to the list of by-gone medical delusions."[1]

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[1] This and the preceding quotation from Holmes also appear in the admirable address of Medical Director A. L. Gihon, U. S. N., President of the section on Medical Climatology and Demography. "Transactions of the Ninth International Medical Congress," held at Washington, 1887, vol. v.

The influences of climate, custom, and nationality upon diet and the reciprocal relations of diet upon customs and ethnical traits are of the highest importance in the study of demography. Dr. Gihon (*loc. cit.*) says that "the food of a people largely determines its national characteristics, but climate determines the food." He supplies the following apposite illustration: "The Chinese of the northern provinces live on millet and wheat and vegetables, because these thrive best in the dry and dusty soil and severe winter; while the moist, hot climate of Southern China produces rice, which with fish, is the staple aliment of many millions of people. The lack of variety harmonizes with the conservatism of the race, and has contributed to that spirit of contentment and domesticity which, as in Japan, are elements of rare happiness not enjoyed by nations boasting a higher civilization." The relation of this to the subject under consideration is twofold. First, in selecting a dietary for a sick person, it is important to learn what kind of food his stomach is accustomed to, as, other things being equal, it will also be the kind that he can most readily assimilate. Secondly, many diseases are traceable to the food being insufficient in quantity, or deficient in quality, or improperly combined. Thus, insufficient nourishment produces anæmia (anhæmatosis), emaciation, debility (neurasthenia), myalgia, neuralgia, and probably rachitis, scrofula, and is an active predisposing cause for phthisis. Food of inferior quality causes such wide-spread disorders as pellagra, beriberi, or kakké, and ergotism. Improperly-assorted food causes Bright's disease, scorbutus, many of the disorders of infancy, gout, rheumatism, and possibly cancer (?). Other disorders due to infected food, such as trichinosis, hydatid disease, intestinal parasites, and infectious disorders,—cholera, typhoid fever, dysentery, etc.,—need only be mentioned here in order to put us on our guard, so that the dietary for the sick may be quite innocent and free from such disturbing elements. Dr. Gihon insists upon the relationship between food and climate, and points out the fact that the climate of India and equatorial Africa is deadly to those Europeans who keep up the style of eating and drinking that they follow at home, whereas others who suit their dietary to the climate find themselves not injured by it. Major Charles E. Woodruff, Surgeon U. S. A., declares, on the contrary, that the tropics are not suitable for white races, especially the blondes, on account of the excess of light, which is too stimulating for them. He denies that the white races can become acclimated to the tropics.

The proportion to be preserved in the daily diet of man has been especially studied by the civilized nations of the earth in order to determine the best ration to issue to large bodies of men employed in the military and naval services, so as to maintain them in health and the highest degree of efficiency. It may therefore be of interest to give a recent statement as to the dietetic requirements of the army. The equivalent ration for United States soldiers on duty in the tropics is calculated by Capt. E. L. Munson, Assistant Surgeon U. S. A., as follows:—

Articles.	Quantity. Oz.	Protein. Gr.	Nitrogen. Gr.	Fat. Gr.	Carbohydrates. Gr.	Fuel-value. Calorics.
Fresh Beef	10	41.68	6.67	44.75	. . .	590
Or Fresh Mutton	10	46.20	7.35	62.90	. . .	720
Or Pork	6	27.54	4.40	112 54	. . .	1093
Or Bacon	6	15.64	2.49	105.06	. . .	1042
Or Salt Beef	10	40.27	6.44	64 68	. . .	688
Or Dried Fish (Cod)	10	45.37	7.26	1.13	. . .	197
Or Fresh Fish (Average Whole)	14	31.73	5.07	0.79	. . .	120
Flour	18	55.08	7.90	5.60	380 46	1850
Or Soft Bread	20	53.83	8.61	6 80	299.20	1506
Or Hard Bread	18	73.12	11.74	6 63	371.81	1926
Or Cornmeal	20	50 40	7.99	12.40	425.80	1986
Beans	2 4	15.16	2.42	1.22	40.18	240
Or Pease	2.4	16.38	2.62	0.75	41.80	246
Or Rice	4	8.75	1.40	0 45	88.87	407
Or Hominy	4	9.20	1.47	0.67	88 75	430
Potatoes	16	9.50	1.52	0.45	81.70	380
Or Potatoes, 80 per cent.; and Onions, 20 per cent.	16	8.60	1.40	0.72	73.09	340
Or Potatoes, 70 per cent.; and Canned Tomatoes, 30 per cent.	16	8.16	1.30	0.58	62.59	297
Dried Fruit	3	1.77	0.27	1.53	33.80	220
Sugar	3.5	. . .	. . .	. . .	94 25	397
Or Molasses	1 gill	. . .	. . .	. . .	56 05	269
Or Cane-syrup	1 gill	. . .	. .	. . .	56.25	269

The diet of athletes is of great importance, as they require a nutritive differing from a laboring man in that the work of the former is very severe, but of short duration. The laborer's diet is adapted for a sustained exertion, the athlete for short, but severe, exertion. W. O. Atwater made seven studies: four on Harvard-University crews, two on Yale-University crews, and one on the captain of one of the Harvard crews. The results of these investigations showed that the food consumed by these athletes contained a daily average of 155 Gm. (or ℥v) of proteids, 177 Gm. (or ℥v $^{3}/_{4}$) of fat, and 440 Gm. (or ℥xiv $^{1}/_{4}$) of carbohydrates, and had an average energy value of 4085 calorics. The prominent characteristic of such a dietary is the large amount of proteid; the energy-value is equal to that of severe labor, the proteid is sufficient for more severe labor than that of energy.

While physicians are rarely consulted with regard to the selection of food in health, men being guided by the cravings of their appetite and the force of custom in eating, yet a recognition of the existence of this factor in any case of disease will naturally lead to such regulation of the diet as is most favorable for restoring and maintaining health. This truth was properly appreciated by the ancients, who made some applications of it, guided by experience alone. It is a fact, as stated by Prof. J. Bauer, that "the scientific basis of a system of rational dietetics could not be laid until the first principles at least of the processes of digestion and metabolism in the human body, under normal and under pathological conditions, were known." Acquaintance with the chemical composition of foods and proximate principles and knowledge of the part played by each in the organism

were necessary before we could properly solve the relation of the dietetics to diseased conditions and make the proper selection of viands for the sick. Two difficulties are met at the start: the kind of food that science would indicate, as the most appropriate might be repugnant to the patient, who would refuse to take it, or, having taken it, such food might not be capable of being digested and assimilated as well as other articles which are less desirable, but more digestible; secondly, the condition of the digestive organs is such that their ability to eat ordinarily articles of food is suspended. In many diseased conditions the waste of the tissues is increased, while the power of the organism to assimilate food is diminished; so that it is difficult, if not impossible, to introduce nourishment in sufficient quantity to make up for the loss. This is especially manifest in acute febrile processes, which are usually accompanied by more or less involvement of the organs of digestion. If the power of digestion is suspended for the time, it is necessary to withhold food, until it is, in part at least, restored; otherwise the food would remain undigested in the alimentary canal, and, becoming the subject of fermentative or putrefactive change, it would give rise to additional irritation. Where it is not entirely abolished, we may aid in keeping up the patient's strength by small quantities of bland, easily-digested foods until he is in a position to take more substantial foods. If emaciation is progressing and the patient losing strength, the administration of highly-nourishing foods is imperative; if they cannot be retained or digested by the stomach, they may be administered by enema. In extreme emergencies, we may even inject nutritive substances into the veins, or hypodermically, or blood may be injected into the peritoneal cavity. Baths of milk have been proposed, but, as stated in a previous section, they have no nutritive value. Fatty nutritious substances, like lard, olive-oil, butter, codliver-oil, etc., may be introduced by inunction with great benefit, combined with friction or massage to assist in their absorption.

On the other hand, in plethoric, well-nourished individuals, where the process of denutrition is not going on very rapidly, entire abstinence from food for a brief period will do no harm. After surgical operations, it is sometimes advisable to allow the patient to go without food for several hours before the operation is performed, and for twenty-four hours afterward, allowing nothing but water in teaspoonful doses.

The so-called hunger-cures, in which fasting is followed as a therapeutic measure, are not popular at the present day; but they have, undoubtedly, much to commend them in cases of plethora and so-called subacute rheumatism. In cases of acute pneumonia, food should be of the lightest character, as the rule, and in most acute diseases, where the patient is not asthenic, the diet should consist principally of what are called accessory foods and light broths until convalescence is established, when a more varied *menu* may be permitted. It is evident that many circumstances require to be considered and duly estimated in laying down a dietary for a patient. The extremes of life bear abstinence poorly, as the rule, and success in treatment will often depend upon the maintenance of supplies of food; on the contrary, well-nourished adults may live for a considerable time with the minimum of nourishment. Less food is needed, as the rule, in summer than in winter. At the present day there is a tendency to overfeeding, both among the sick and the well; and where disorders are due to excess of certain forms of nourishment, as particularly insisted upon by T.

Lauder Brunton and Milner Fothergill, diminution of food and careful regulation of diet is of more consequence than drugs.

Some of the phases of the question of alimentation have been more fully considered by the author elsewhere[1] than is possible here. It will be only possible to present here a brief outline of the paper referred to. The fluids and solids which enter into the composition of the human body are constantly the subject of change under the influence of cell-life, and after serving their purpose are excreted from the body. This necessitates renewal by process of nutrition, and such substances are introduced mainly by the food and drink. Chemically, the proximate principles of the food are inorganic (or mineral) and organic, the latter being divided into those not containing nitrogen and those containing nitrogen. Non-nitrogenous substances are again subdivided into hydrocarbons and carbohydrates. Carbohydrates (starch and sugar) contain hydrogen and oxygen in the proportion to form water. Hydrocarbons (oils and fats) are compounds of hydrogen and carbon, combined with a small proportion of oxygen. In addition to these three principal varieties of organic substances, we consume organic acids, present in vegetables and fruits, and pectin, which occupy an humbler position in regard to nutrition, but which assist in maintaining animal heat. Nitrogenized organic substances find their type in albumin, and, on account of their importance, they are often called "proteids." Albuminoids are characterized by the presence of carbon, hydrogen, oxygen, and nitrogen with other elements variously combined. They occur both in the animal and vegetable kingdoms. The problem of digestion is to render albumin, sugar, starches, fat, and other food-ingredients soluble in the gastric and intestinal fluids. Albumin is rendered soluble by being converted into peptones through the activity of the gastric juice, and, in the small intestine, by the alkaline pancreatic fluid. Starch becomes maltose and glucose; this is partly accomplished by the saliva and partly by the pancreatic and intestinal juices. The bile favors the absorption of fat by emulsifying it, and, by its action upon the villi and its antiseptic qualities, preventing the fat from being converted into fatty acids. The pancreatic secretion also acts upon the fatty articles, emulsifying them and favoring their absorption. The portal blood and liver transform peptones into serum-albumin, and change the glucose derived from starch back again into an insoluble form called glycogen, in which shape it is stored up in the cells of the liver, to be given out in small quantities, as it is needed to supply energy to the tissues. Fat is absorbed and gradually assimilated by the lacteal vessels and general circulation.

This review of the physiology of food is a necessary introduction to the consideration of its proper administration in health and disease. As the present discussion is limited to the latter, we will omit discussion as to the relative quantity of each form of food, only stipulating that each shall be represented in a full dietary. In this country there is, without doubt, too great consumption of nitrogenized food, which leads to diseases of the kidneys and liver, with many obscure symptoms that find their place under the heading of lithæmia or uræmia. These are often removed by restricting nitrogenous food or entirely removing meat from the diet.

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[1] "Food and Diet in Health and Disease," *Medical Bulletin*, Jan., 1892.

Habits of eating affect the results. Some forms of indigestion or dyspepsia are clearly traceable to insufficient mastication of the food. The therapeutic teaching here is not to change the diet, but to tell the patient to eat more deliberately and chew his food thoroughly. Good food may be spoiled by poor cooking, and the digestibility of food is very much affected by the manner of preparation. The frying-pan is such a frequent cause of indigestion that it has been almost banished from well-managed households.

Different aliments vary as to their digestibility. This depends upon their nature, mode of preparation, age, time of year, mode of life among animals, and affects their value as foods. The flesh of young animals, though soft and tender, is too albuminous and is less digestible than the older members of the same species,—veal and lamb being less digestible than beef or mutton. If, on the other hand, the animal is too old, its flesh is apt to be tough, unpalatable, and indigestible, but makes better broth than the very young animal. Eggs and milk are much used in the sick-room, on account of their nutritious qualities and ease of assimilation. Among starchy foods, bread is at the head of the list; it is, when well made, very acceptable and usually readily digested. If a little stale, or slightly toasted, it becomes more acceptable to invalids or convalescents. Rice is also a useful carbohydrate; with it may be named farina, tapioca, sago, and cornstarch, from which many articles of food for the sick are made. Pease and beans are less digestible on account of their thick, testaceous envelope and the presence of albumin in the form of vegetable casein or legumen. Potatoes, when baked, are usually acceptable to convalescents. Many vegetables are liable to cause indigestion, from the amount of cellulose which they contain. Fruits are likewise beneficial to the system. Poor in albumin, rich in water, they are chiefly of value on account of the vegetable acids, salts, and carbohydrates which they contain. They diminish the acidity of the urine, many of them produce a laxative effect, and they counteract an injurious influence of the undue restriction of the diet to dried and salted meats. Apples open the bowels and will often allay nausea. Certain fruits, on the contrary, possess astringent properties, and are useful in relaxed conditions of the bowels. Tea, coffee, and cocoa are valuable arterial stimulants, and, with milk and sugar, are nutritive. Chocolate contains about 20 per cent. of albumin and 50 per cent. of fat, with an alkaloid (theobromine) allied to caffeine. It is a valuable condensed food; acting also as a mild laxative. Its large proportion of fat will often render it unsuitable for weak stomachs. The question of the administration of alcohol is considered in another place (see Part II). Lighter wines or malt liquors have some nutritive value, and when used in moderation are useful, especially among elderly people.

As regards the interval between the administration of articles of food, this should be prescribed as carefully as the taking of medicine. Where the amount given at a time is small, the interval must be correspondingly short, having in mind the total amount of nourishment to be taken in the twenty-four hours. The night is long for a sick person and directions for the administration of some light nourishment should be given. Sometimes insomnia is relieved by taking food at night. In dyspepsia and chronic indigestion, the question of diet is difficult to solve. Many of these cases have gastric catarrh, which requires to be relieved before digestion can be improved. The microbes of fermentation and putrefaction, which cause flatu-

lence, pyrosis, and various nervous disorders,[1] are present, and interfere with the normal digestion of foods. It sometimes is advisable to place such patients upon a restricted milk diet, giving a tablespoonful of sterilized milk every hour or hour and a half, increasing it, day by day, until six ounces or more are taken every ninety minutes, at which it may be continued for a specified time,—a month or six weeks,—when articles of food, properly selected, may be added cautiously to the dietary. Where there is marked hepatic disorder, accompanied by oxalic-acid or uric-acid deposits in the urine, with headache, pains about the body, and lowness of spirits, it will be advisable to limit the albuminous food or forbid meat altogether for a time. In very severe cases of indigestion, especially in young infants, it will be advisable to administer only predigested food for a time.

In the management of constipation much can be accomplished by selection of the food. Articles of service in such a condition are those which leave a residue in the bowel, as bran bread, certain vegetables, as cabbage, carrot, turnip, beans, asparagus, and spinach; those which produce transudation into the intestine, as many fats; and those which excite peristalsis, as oils. Honey and syrup are likewise of assistance. On the contrary, fancy breads, biscuits, cakes, and rice are to be avoided.

In weak and impaired action of the digestive organs, articles which readily ferment or turn acid should not be used; sugar, honey, starch or starchy substances, and fat should be avoided as much as possible. Bread should be stale or toasted. Fish, fowl, pork, veal, chocolate, strong coffee or tea, or an excess of water or of other liquids, should be interdicted. Wines and liquors should be sparingly used, if at all. In the weakened digestion of elderly people, articles of food which are easily assimilated should be selected, while indigestible food should be avoided. Diminished appetite and secretion demand the most nutritious diet. Soft, but concentrated, food, broths containing malt-extract, milk-food, or some of the better forms of baby-food are used with great advantage. The sedentary life led by such patients does not require much food, and little, if any, meat. A little wine or malt liquor will assist digestion, if it is otherwise suitable, especially in elderly people, or during convalescence.

Anæmia and chlorosis require a highly-nitrogenized diet, making the change gradually, as the stomach may be intolerant. Oysters, sweet-bread, underdone beef, with dish-gravy on potatoes or rice, with a glass of wine or extract of malt, are decidedly beneficial. Koumiss answers well, being both nutrient and mildly stimulant. Kefir is milk, fermented by a form of yeast, and is highly prized in Russia. An aërated milk or milk charged with carbonic-acid gas has been introduced by Professor Botkin and used in cases of feeble digestion. It is said to be more palatable than ordinary cows' milk and to constitute a refreshing drink, especially in summer.

In neuralgia, the nutrition is often below par, and in patients subject to neuralgia a generous dietary of easily-assimilated blood-making food, with a glass of Hungarian or some native red wine at meals, and the free use of butter, cream, and other fats, will often exert a salutary effect. A cheap method of administering fat has been proposed by Dr. Mershinski. It con-

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[1] T. Lauder Brunton: "On Poisons Formed from Food and their Relation to Biliousness and Diarrhœa." *The Practitioner*, Aug., Sept., and Oct., 1885. Also, "On Disorders of Digestion, their Consequences and Treatment," London, 1886.

sists in boiling together milk and lard for a considerable time; the resulting fluid, containing a large proportion of fat, is generally well borne, and causes an increase of weight. It is thought to be well adapted to hospital patients suffering from malnutrition unconnected with disease of the stomach, intestines, pancreas, or liver.

Diabetes, in the mild form of glycosuria, is easily controlled by limiting sugar or starchy foods and leading an out-door life. Saccharine diabetes is sometimes intermittent, and its causes are not well understood; evidently it may result from several causes, some of which are slight and inconstant, others are grave. In the more serious form of diabetes mellitus, the withdrawal of starch and sugar from the dietary has very little effect upon the excretion of sugar, which apparently comes from the tissues, since emaciation rapidly continues. In either form, however, the diet is of great importance. There is a difference of opinion as to whether sugar and starch are to be actually prohibited or only reduced to a minimum quantity. Da Costa allowed some wheat bread, in order to retain the co-operation of the patient, who may rebel against a too-restricted diet. It is plausibly argued that absolute prohibition of starch will deprive the system of a necessary aliment and increases nitrogenous metabolism; so that a small and regulated allowance of amylaceous food will generally be found of advantage. The diminution in carbohydrates may be compensated by the ingestion of fat. Coffee or tea may be sweetened with glycerin or with saccharin. Gluten bread for diabetics usually contains starch. A bread made from almond-flour has been recommended. Experiments have recently been made by Dr. W. Hale White in regard to the use of the soya-bean in diabetes. This article is obtained from a Japanese plant. The beans are globular, and about the size of pease, which they resemble in taste. From their flour bread and biscuit can be made and can be advantageously used as a substitute for wheaten bread, as the bean contains but a small proportion of starch. The bread is palatable, and Dr. White reports that it answers a good purpose. He thinks that it is of more avail than gluten bread in reducing sugar in the urine, and found no ill effects from its use. The beans can also be made into a soup. Another substitute for wheat is found by Erbstein in **aleuronat**, a vegetable albumin which contains about 80 per cent. of nitrogenous matter and only about 7 per cent. of carbohydrates. Aleuronat is a dry, yellow powder, free from taste or smell. From it both bread and broth can be made.

The question of infant-feeding is too large to go into here. The chief evils of bottle-feeding are (1) overfeeding, (2) too frequent feeding, (3) impure milk, (4) dirty bottles or nipples, and (5) want of uniformity in composition, quality, and temperature of the bottle. That food is best for the child upon which it best thrives and grows, presenting the appearance and physical characters of a healthy infant.

When it becomes necessary to artificially nourish an infant, the physiological guide is the composition of mothers' milk, which contains (besides water) fat, 4 per cent.; sugar, 7 per cent.; and proteids, 1 per cent. The frequency of feeding and the quantity given at each time are inversely to each other, and vary with the age of the child, its physical strength, and digestive capacity; but the feeding should be at regular intervals during the day, so that the child may form the habit of sleeping at night. Infants should not be fed on undiluted or unmodified cows' milk, on account of the excess of casein, although this is less with the Alderney and Jersey than

with ordinary milk. In order to avoid the danger of tubercular infection, of communicating typhoid and other diseases, it is advisable always to scald the milk. The addition of boiled water or rice-water, with a little salt and sugar, and of lime-water, is generally approved.

For the home **modification of cow's milk** for children of different ages the following table has been devised. By the use of a special dipper (Chapin) the top milk may easily be separated; or a teaspoon may serve to remove the first ounce or two from the milk bottle. In the city, it is advisable to Pasteurize the milk as soon as delivered. The slight excess of acid in cow's milk may be overcome by the addition of a little lime-water, or a little milk of magnesia (half a teaspoonful) to each feeding, after the milk has been boiled. A larger proportion of water may be used during the summer, when a smaller quantity of food is required by the child.

Table for Home Modification of Cows' Milk.

Age.	After the cream has risen, take of upper part of a quart bottle of fresh cows' milk, "Top Milk"	Take of Milk Sugar	Take of Recently Boiled Water	Intervals of Feeding—hrs.	Number of Feedings in 24 hours	Average ozs. at each Feeding	Average ozs. in 24 hours	Per Cent.		
								Fat	Sugar	Proteid
1st week	3 tablespoonfuls (cream)	4 teaspoonfuls	10 ounces	2	10	1	10	2.5	7.0	0.33
2d week	5 "	4 "	12 "	2½	8	1½-2	12-16	3.0	7.0	0.50
3d week	6 ounces	7 "	22 "	2½	8	1½-2	12-16	3.5	7.0	0.75
4-8 week	9 "	8 "	23 "	3	6	3-4	18-24	4.0	7.0	1.00
9-12 week	11 "	7½ "	21 "	3	6	3-4	18-24	4.0	7.0	1.25
4th mo'h	13 "	7 "	19 "	3	6	3-4	18-24	4.0	6.0	1.50
5-6 mo'h	15 "	6⅔ "	17 "	3	6	3-4	18-24	4.0	7.0	1.75
7-8-9mo'h	17 "	5½ "	15 "	3	6	6	36	4.0	6.5	2.00
10-11mo'h	21 "	4⅓ "	11 "	3	5	8	40	4.0	6.0	2.50
12th mo'h	25 "	2¾ "	7 "	3	5	8	40	4.0	5.5	3.00

Malted soup is made by mixing a large teaspoonful of slowly-baked flour with a little cold water and passing it through a sieve, adding enough hot water to make a quarter of a pint, boiling while stirring constantly, allowing to cool, adding an equal quantity of fresh cold milk with a teaspoonful of plain diastasic extract of malt, and stirring well for a few minutes. For infants less than three months of age, less milk and more water are used.

Rickets has been shown by Cheadle to be due to improper feeding. The treatment is primarily and chiefly dietetic. Drugs are of minor import, though lime and lime-salts, warm clothing, fresh air and sunlight, with proper diet, may do good service. Fatty articles of food are useful, and the diet should also be rich in starches and earthy phosphates in a form easy of assimilation. Infants, soon after birth, are usually able to digest and assimilate small quantities of starch, and clinical experience proves that many infants do thrive upon gruel, porridge, barley- or rice-water, and similar starchy foods, and their use is approved by Jacobi, Chapin, Huebner, and others. Constant feeding with sterilized milk may produce scurvy.

Obesity is a condition in which the system has accumulated a large proportion of surplus nutritive material in the form of adipose tissue. The remedy is abstinence and abstemiousness. The bear retires for his winter's nap in a comfortable condition of obesity; but, after four or five months have passed without eating, he emerges from his hollow tree a model of leanness. Dieting is recommended for obesity, but it should not consist in living solely on meat, as has been recently advised, nor in a dry diet with

abstinence from water and other fluids as much as possible. Such measures will reduce weight, but they will be likely to cause serious disorder of the kidneys. It is better to simplify the diet, take systematic exercise, and reduce the hours of sleep, taking laxatives occasionally to stimulate the excretory organs. The free perspiration caused by active walking is better than that induced by the Turkish bath, which should be indulged in with moderation. The use of vinegar and other acids is said to reduce the surplus flesh, but this should not be followed to any great extent, for fear of bringing on digestive disorders or rheumatism. Mountain-climbing is the best form of exercise, but this should not be carried to the point of fatigue, until the muscles become firmer and more accustomed to out-door pursuits. Changes in the diet, like the increase of exercise, should be made with caution. If the individual is a hearty eater he should be directed to curb his appetite and gradually diminish his repasts. Articles containing much fat, starch, or sugar must be omitted or very temperately consumed. Fat meats, cream, butter, vegetable oils, nuts, fat fish, farinaceous substances, fruits containing much sugar, beverages, such as beer, ale, and sweet wines, should be definitely discontinued. If milk be used at all it should be skimmed; buttermilk may be used, if fresh. No chocolate should be taken, and tea and coffee used without sugar, or sweetened with saccharin. The diet should principally consist of lean meat, poultry, game, eggs, green vegetables, and acid fruits. Not much bread should be eaten; gluten biscuits may be used as a substitute. The dietary which Mr. Banting followed in reducing his flesh from two hundred and two to one hundred and fifty-six pounds, in about a year's time, is as follows:—

Breakfast, at 9 A.M. From 155 to 186 Gm. (or ℥v-vj) of either beef, mutton, kidneys, broiled fish, bacon, or cold meat of any kind, except pork and veal; a large cup of tea or coffee (without milk or sugar), a little biscuit or 31 Gm. (or ℥j) of dry toast,—making together 186 Gm. (or ℥vj) of solids and 270 c.cm. (or f℥ix) of liquids.

Dinner, at 2 P.M. From 155 to 186 Gm. (or ℥v-vj) of any fish except salmon, herring, or eels; any meat except pork or veal; any vegetable except potato, parsnip, beet-root, turnip, or carrot; 31 Gm. (or ℥j) of dry toast; fruit out of a pudding not sweetened; any kind of poultry or game, and two or three glasses of good claret, sherry, or Madeira,—champagne, port, and beer forbidden,—making together 310 to 372 Gm. (or ℥x-xij) of solids and 300 c.cm. (or f℥x) of liquids.

Tea, at 6 P.M. From 62 to 93 Gm. (or ℥ii-iij) of cooked fruit, a rusk or two, and a cup of tea without milk or sugar,—making 62 to 124 Gm. (or ℥ii-iv) of solids and 270 c.cm. (or f℥ix) of liquids.

Supper, at 9 P.M. From 93 to 124 Gm. (or ℥iii-iv) of meat or fish, similar to dinner, with a glass or two of claret or sherry and water,—making 124 Gm. (or ℥iv) of solids and 210 c.cm. (or f℥vij) of liquids.

In leanness, emaciation, and marasmus, the reverse course is to be followed to that recommended in obesity. Frequent eating of easily-assimilated fatty and starchy foods, sweetmeats, an indolent life, warm baths, and several naps a day will be apt to develop the form, especially if the mind be cheerful in accordance with the old maxim: "Laugh and grow fat."

In the management of phthisis pulmonalis, or consumption, next to the climatic treatment we would place the dietetic regulations. According to Professor Peter, cases of consumption frequently have their origin in

disordered digestion, which lowers the vitality to such a degree as to make the organism susceptible to the disease, or, in modern terms, they are made to afford a proper culture-soil for the bacillus tuberculosis. Some relation evidently exists between insufficient food and consumption, and one of the evidences of recovery is the fact that the patient gains in weight. While the patient follows out the recommendations for the removal of leanness, he should not take too large an amount of fat, on account of the inability of the system to assimilate it, and the tendency to the occurrence of fatty liver. Much depends in phthisis upon the condition of the digestive apparatus. When appetite and digestion are unaffected it is well to adopt a system of forced feeding and to administer as much milk, eggs, meat, cream, butter, and cheese as can be assimilated. When gastric disturbance has been begun our aim should be to render the food palatable, and it should be given in a finely-divided state. The administration of porter and ale is beneficial at this stage. If the patient can no longer partake of solid aliment without digestive derangements, nourishment must be given in small quantities, but frequently, and the stronger spiritous liquors are demanded. Assimilation is favored by life in the open air and exercise or massage.

In what is known as latent or undeveloped **gout**, it is of importance that the condition be recognized and due regulation of the diet urged upon the patient by his medical attendant. Dr. William Roberts[1] has called attention to this, in an able manner, in a recent contribution on the necessity of a revision of diet with advancing years. If the appetite remain good while there is a process of degeneration going on in the liver and kidneys, the power of taking food remains unaltered, while the assimilative powers are on the wane. Some form of nutritive disorder necessarily follows. There is frequently a tendency to stoutness; there is engorgement of the abdominal organs, and the signs of latent gout are likely to appear. The early recognition of this condition is very important, for thereupon depends the prevention or postponement of degenerative processes, which hereafter prove formidable. The most obvious indication is to lessen the quantity of food, and this is a task of varying difficulty.

"Full feeders are rarely aware that they eat too much," says Dr. Roberts. Where the appetite is really strong and the digestion abnormally active, the patient finds it hard to resist the demands of hunger. In such cases, "the less concentrated forms of food are a useful resource (green vegetables, salads, thin soups), which help to fill the aching void without adding materially to the albuminoid and fatty ingredients of the meal. Tea and coffee are also serviceable in allaying an unseasonable craving for food. A stiff cup of tea or coffee, shortly before dinner, certainly takes the edge off a troublesome appetite. It is well, however, to proceed cautiously and tentatively in this direction, for the promptings of nature, however apparently to us misdirected, are not to be lightly set aside. The effects of a contracted diet should be carefully and patiently watched, with an open mind for every sign or suggestion, whether of warning, retreat, or of encouragement to advance. I need hardly add that, in regard to this middle-life revision of the dietary, as it may be termed, particular attention should be given to the quantity of alcoholic beverages. As a very general rule, the

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[1] *British Medical Journal*; *American Lancet*, Dec., 1891.

tolerance for these articles diminishes with advancing years, and it is necessary nearly always, with persons who have used them freely, to reduce their quantity when middle age is reached." The consumption of fruit is beneficial when a tendency to lithæmia exists, as the alkaline vegetable salts are converted into carbonates, which pass off in the urine.

With regard to the ability of the organism to assimilate nitrogenized food in fever, exact observations have finally established the conclusion that seemed warranted by experience. Huppert and Riesell maintained that the administration of albuminates intensified the febrile consumption, and is comparable to pouring oil on a fire. This was opposed by Uffelmann, and controverted entirely by some exact observations made by Bauer and Kunstle. A diet, therefore, consisting exclusively of carbohydrates is not desirable in fever, any more than in health, and, therefore, the addition of gelatin to farinaceous broths, or the administration of beef-juice, bovinine, or Mosquera-Julia beef-meal is advisable, *wherever the digestive organs are capable of assimilating it*, and in quantities suitable to the condition of the digestive organs. In **typhoid fever** a milk diet is preferred by most clinicians. Beef-tea has been finally superseded by various prepared foods containing peptones, beef-juice, or hæmoglobin, as already mentioned. Toast-water may be used to satisfy thirst; all the water drunk should first be boiled, and, if cloudy, strained previous to boiling, before giving it to the patient. On account of the duration of typhoid, the nourishment of the patient should be properly looked after, in order to keep up his strength. Stimulants should not be used as a matter of routine, but may be used sparingly, as an accessory food, during the decline of the fever.

The diet of persons suffering with **albuminuria** and Bright's disease should be carefully watched, bearing in mind the statement of Prof. George Johnson, that "renal degeneration is a consequence of long-continued elimination of products of faulty digestion through the kidneys." The starting-point of Bright's disease, in the words of Fothergill, is "liver incapacity." This incapacity of the liver, which prevents it from properly assimilating albuminoids, may arise purely from mental worry or overstrain (Clifford Allbutt); it may be due to an excess of excrementitious material in the blood accompanying certain cachexiæ, as gout or lithæmia; it may possibly arise from defective kidney action, the result of scarlatinal or other poison. In any case, when the products of malassimilation pass through the kidneys they ultimately lead to degeneration of a granular character, which may or may not be attended by albuminuria. In some cases the fault may be traced directly to overindulgence in animal food. The first step would be to restrict the amount of lean meat consumed, and direct the patient to avoid highly-seasoned food and spices. In many cases the best results are obtainable by placing the patients strictly upon a milk diet, which should be skimmed, or, at least, not Alderney. The food should be sparing in quantity, consisting largely of vegetables. Desserts may be allowed of a simple character, but the patient should be cautioned against free indulgence in the pleasures of the table. As the rule, alcohol is forbidden. Soups are useful, fish not objectionable. Cream, butter, and other fats are restricted. Gruels, broths, vegetables, biscuits, bread, crackers, and cheese may be mentioned among the articles which may be employed with advantage. Albuminuria is not the whole of Bright's disease, and may exist temporarily from dietetic causes, without degenerations of the kidneys. In a

diet rich in albuminoid matter, the urine is apt to be albuminous. In such a case, the remedy suggests itself in due attention to the diet.

The subject of the dietary in various diseased conditions is admirably reviewed in the modern systematic works on the subject. In the present place we have room only for some useful formulæ, which may be employed in the sick-room with advantage to the patient. At the present time, the physician is not only expected to know what articles of diet are suitable for the patient, but he is also expected to be able to give precise directions how to prepare them, and, in emergencies, to step up and show the nurse or attendant how the thing should be done:—

FORMULÆ FOR SPECIAL FOODS.

Beef-tea.

Take a pound of lean beef, free it from fat and fibrous tissue, cut into small pieces, place these in a crock or fruit-jar, with a good cover. Add to it a quart of cold water and ten or twelve drops of dilute hydrochloric acid, and stand in a moderately-warm place for an hour; then let it simmer gently for two hours more, then strain and season with salt and pepper, if desired. It should be strained, and administered hot, an ounce or two at a time.

Beef-essence.

The same as above, except that no water is to be added to the meat, which is placed in the fruit-jar and the lid fastened down; the jar is then placed in warm water, which is gradually raised to boiling and kept at this temperature for three hours. It is then taken out, strained, and seasoned with salt.

Beef-juice.

Broil small steaks lightly, and then make incisions into them and press them in a lemon-squeezer or wine-press; the juice to be taken hot, alone, or with toast.

Raw-Beef Infusion.

To a pound of beef, prepared as above, finely minced, add enough warm water to cover it, and ten drops of dilute hydrochloric acid. Let it stand for two hours, at a temperature of ninety degrees, frequently stirring it with a glass rod. It should be kept on ice, and administered with milk or a little extract of malt.

Raw Beef.

Raw, lean beef, free from fat, may be pounded into a pulp in a mortar with some white sugar, and spread upon bread, to be taken as a sandwich by young children or rachitic infants. Or, with a rather dull knife, scrape a piece of tender meat, so as to separate the pulp from the fibrous portion. The soft mass thus obtained may be seasoned with salt and pepper, like sausage-meat, and eaten, spread upon biscuit or bread; or it may be molded into small balls and slightly browned on the outside in a hot oven. Meat-pulp may also be rubbed up with half its quantity of granulated white sugar, and in this form is readily taken by young children.

Beef-tea, No. 2.

Prepare a pound of good rump-steak by chopping it in small pieces and removing pieces of fibrous tissue and fat. Place it in a pint of cold water in a covered saucepan. Let it stand in a cool place for three hours, and then place it on the fire, where it may simmer gently for fifteen minutes; season, and decant or strain through a horse-hair sieve. The meat should be as fresh as possible, and the saucepan enameled upon its inner surface. Beef-tea must never be allowed to actively boil, and in reheating it should only be raised to the proper temperature for drinking.

Calves'-feet Broth.

Two calves' feet are to be carefully cleaned and placed in two quarts of cold water, which is then brought to boil and kept boiling until the feet are reduced to shreds; strain liquid portion off, and add a little salt, and pepper if desired. When

administered to the patient, it is to be warmed. It may be made more nourishing if, to each cupful, a beaten egg and two tablespoonfuls of fresh milk are added, and all brought quickly to a boil before serving. A dash of lemon-juice improves the flavor, and the broth may be taken with some crisp toasted bread.

Clear Brown Soup.

Take a shin of fresh beef, cut it in pieces, and put into a saucepan with enough cold water to cover it. Bring it to a boil, and add a bundle of sweet herbs, vegetables (a little sliced carrot, turnip, onion, celery, etc.), also pepper and salt to taste. Boil until the meat is tender, then strain, and let it stand in a cold place until the next day. Remove the fat from the surface and heat the broth, adding as much browning as will make the soup a proper color. Beat up two eggs with their shells until quite a froth, and put them into the soup with a whisk. Let it boil gently for ten minutes, when it may be decanted, or, if desired, it can be strained through a cloth, when it will be perfectly clear.

Consommé, or Bouillon.

Take one or two pounds of beef from the leg, round, or chuck; wash well, cut in pieces, and put on to boil with three quarts of cold water. Skim frequently while boiling, and, when reduced to a quart, take from the saucepan and strain. Return to the saucepan and add a few thin slices of onions, half a pound of lean beef, chopped fine and well mixed with three raw eggs. A few bay-leaves may be added. Beat all thoroughly into the broth, which is to be returned to the fire and boiled for about half an hour. It should be made clear by straining through horse-hair sieve or muslin, and seasoned.

Oyster-soup.

The desired number of oysters, depending much upon their size, are allowed to drain through a colander for five minutes, and the liquor preserved. A pint of boiling water is then poured over them, which is thrown aside. Add to the liquor already drained a pint of hot water, and put over the fire in a porcelain-lined saucepan. Boil until all the scum has risen and has been skimmed off, then add half a pint of fresh milk, one powdered water-cracker, a piece of butter, and a little salt and pepper. One or two allspice may also be added. Boil for ten minutes, and, just before the soup is served, turn in the oysters from the colander and let them scald for three minutes, and then send to the table in a covered dish.

Chafed or Panned Oysters.

Take a dozen large oysters, drain off the juice, and preserve it. Have a silver chafing dish or a porcelain-lined vessel over a fire, and place a piece of butter, as large as a walnut, in the vessel. When the butter indicates that the dish is sufficiently hot, the oysters are turned in, and a little salt and pepper added. When the oysters change color and curl up, they are placed in a hot dish. The oyster-juice is now turned into the chafing-dish, with a little cream, and brought to a boil and poured over the oysters. Dry toast may be cut into squares and served with the broth, if desired.

Roast Oysters.

A dozen fresh oysters, not long out of their native bed, in their shells, are placed upon a stove or on a moderately strong fire until the shells open a little. They are then opened, preserving the juice, if possible, and served hot, with a little black pepper and salt, if needed. The tough part of the oyster (cartilaginous portion) need not be swallowed, if the patient be delicate. This is said, by Dr. Henry Hartshorne, from personal experience, to be relished and digested sooner than any other solid food in convalescence after fever.

Vegetable-soup.

Put two potatoes, a handful of pease, one ripe tomato, and a piece of stale bread into a quart of water, and boil to a pint. Add chopped celery or parsley and salt. Keep in a covered dish. Strain when served, if for a delicate stomach. It may be made more nutritious by adding the yelk of one egg to each cupful, or some meat-extract, like Liebig's or Armour's.

Bread-and-Butter Soup.

A piece of well-baked, rather stale, bread is to be spread with good, sweet butter and sprinkled with salt and pepper. Pour a pint of boiling water over it and allow it to stand for a few minutes. When cool enough, it may be eaten as an article of low diet by convalescent patients.

Panada.

Two pieces of stale bread, deprived of crust, are to be toasted brown and cut into small squares. Lay them in a bowl and sprinkle with salt and a little nutmeg. Pour on a pint of boiling water, and let it stand to cool.

Toast-water.

Two pieces of stale bread are thoroughly browned in a hot oven. They are then placed in a bowl or pitcher, and a pint of boiling water poured over them. After standing until cold, the water is poured off into a pitcher and a slice or two of lemon placed on top. If desired, it may be sweetened with some crushed sugar and served cold. Patients are allowed to drink it freely, in place of water.

Tamarind or Currant-jelly Water.

A refreshing drink may be made for patients, in summer particularly, by placing some preserved tamarinds, free from their shells, in a glass of water which had been previously boiled. Where tamarinds are not to be had, currant-jelly may be used in the same way, in cases of bowel disorder or to allay thirst in fever.

Lemonade.

Take two large, fresh lemons, and wash them clean with cold water. Roll them until soft; then divide each into two, and use a lemon-squeezer or reamer to express the juice into a small pitcher. Remove all the seeds from the juice; to which add four or more tablespoonfuls of white sugar, according to taste. A pint of boiling water is now added, and the mixture stirred until the sugar is dissolved. It should be drunk while hot, and is very effective in producing perspiration. Ice-water may be used instead of the hot water, and a piece of lemon-peel added; if desired, a weaker lemonade may be made by using more water. This is a refreshing, acidulous, and antiscorbutic drink, and is especially refreshing in hot weather. Limes or lime-juice may be used instead of lemons.

Milk-jelly.

Dissolve one ounce of gelatin in a cupful of warm water. Heat a quart of milk with a pound of white sugar for about ten minutes, aiding the solution of the sugar by stirring. Let the solution cool, and then add the gelatin solution, the juice of three or four lemons, and half a pint of wine or two wineglassfuls of brandy, stirring the mixture slowly, and pour into glasses or molds and place in a cool place to stiffen. The object of allowing the milk to become cold is to prevent curdling when the other ingredients are added.

Gelatin.

An ounce of sheet gelatin is dissolved in a pint of warm water, and this brought to a boil. Add a half-cupful of sugar, the juice of one lemon, and the white of an egg. Beat together well and pour into a mold and keep on ice. Serve a tablespoonful at a time, so as to encourage the patient to ask for more.

Wine-jelly.

One box and a half of Coxe's gelatin soaked in water one hour must then have added three pints of boiling water, one pint of sherry-wine, and two pounds of white sugar. The white of an egg and juice from three lemons are then added, and all strained through a fine sieve. The rind of one lemon is then sliced and put in, or small pieces of orange or other fruit used in place of the lemon-rind. Pour into cups or molds and allow it to stand until it hardens.

Tapioca-jelly.

One cupful of tapioca is washed, and then placed in three cupfuls of cold water to soak for four hours. It is then placed in a water-bath and heated until it begins to clear, adding more lukewarm water if too thick. When quite clear add the juice of a lemon, a pinch of grated peel, and sweeten to taste. Pour into molds. Serve cold with cream flavored with rose-water and sweetened.

Arrowroot-jelly.

This is made like the preceding, using one cupful of boiling water to two heaping teaspoonfuls of arrowroot, and the same quantity of white sugar. A tablespoonful of brandy or three tablespoonfuls of wine make an agreeable addition.

Restorative Jelly.

One-half box of Coxe's gelatin, one tablespoonful powdered gum arabic; one-half pint port-wine, a tablespoonful of lemon-juice, three tablespoonfuls of white sugar, and two cloves are mixed together and soaked for two hours. The mass is then placed in a bowl in a basin of boiling water, or a water-bath, and the ingredients dissolved by heat and constant stirring. Boil for a minute after the ingredients are melted, and then strain through a sieve or flannel jelly-bag, and set aside to cool. The port-wine may be replaced by any other liquor or beef-juice, if preferred. In the latter case, omit lemon and sugar and use salt. A spoonful at a time is sufficient for very ill patients.

Wine-whey.

Boil up half a pint of fresh milk and remove any scum that is formed. Stir in a wineglassful of sherry-wine and boil for a moment longer; strain as soon as the milk is curdled. Put on the ice, or, if used as a warm drink, serve at once.

Milk-punch (Egg-nog).

Beat the white of an egg into a froth and add to a tumblerful of cold, sweet milk and two tablespoonfuls of brandy well stirred in. The yelk of the egg is rubbed up with a tablespoonful of granulated sugar and mixed thoroughly with the other. A little nutmeg on the surface improves the flavor. It should be taken at once, quite cold, and preferably through a straw or glass tube.

Egg-lemonade.

Take the white of an egg, a tablespoonful of pulverized sugar, juice of one lemon, and one goblet of water and mix them intimately. A useful drink in sore throat.

Sago-milk.

Put three tablespoonfuls of sago in a cupful of cold water and let it stand one hour. Add three cupfuls of boiled milk; sweeten and flavor to taste. Allow this to simmer on a slow fire for half an hour; serve warm.

Rice-water; Barley-water.

The rice, or barley, is washed and added to cold water, in the proportion of a tablespoonful to a pint. Allow it to stand in a warm place for two hours, then boil slowly for one hour, or until the water is reduced to one-half, and strain. If too thick, it may be thinned by adding boiled water or boiled milk. It is very useful in cases of summer diarrhœa, especially in children.

Rice-milk.

Two tablespoonfuls of rice and one teaspoonful of cornstarch are added to two pints of milk, and boiled in a farina-boiler until each grain of rice is soft and the whole assumes a creamy color. It may be sweetened and flavored as required.

Baked Milk.

If half a gallon of milk be placed in a jar and the top covered by tying writing-paper over it, and allowed to stand in a moderate oven for eight or ten hours, it will be like cream in consistency, and delicious to the taste.

Flour-ball.

Tie up a quart of wheat-flour in a pudding-bag tightly. Put into a pot of boiling water and keep it boiling for ten or twelve hours. Take the hard mass out of the bag and allow it to dry before the fire. Peel off and throw away the thin outer portion, and grate down the mass with a nutmeg-grater into a powder, as wanted for use. One or two teaspoonfuls of this may be rubbed into a paste with some milk and then stirred into a pint of milk, over the fire. The milk should only be scalded; that is, just brought to the boiling-point without being boiled. This is a valuable article of food in diarrhœa, especially in children.

Egg-broth.

Mix two ounces of pearl-sago in half-pint of cold water, and let it stand half an hour. Then boil until it becomes smooth and sufficiently thick. Beat the yelks of four fresh eggs, with half a pint of cream; then mix with the sago, and stir the whole well with a quart of beef-tea or chicken-broth, just made, at a boiling heat.

Caudle.

Beat up a raw, fresh egg with a wineglassful of sherry-wine, and add to it half a pint of hot oatmeal, Indian meal, farina, or gruel. Flavor with lemon-peel, nutmeg, and sugar.[1]

Farinaceous Beef-tea.

To beef-tea, prepared as in the formula first given, add a little well-cooked oatmeal or cracker-dust, and serve hot. Barley-water or rice-water may be likewise enriched by beef-tea.

Beef-broth.

Take a shin of beef (cracked), and cook, in sufficient water to cover it, for two hours, with rice or barley and a potato. Season with a piece of onion, thyme, or parsley, as may be preferred. Allow it to cool, take off the fat, serve hot, with some of the rice or barley, if permitted, and salt or pepper as desired.

Mutton-broth.

Cut up two pounds of lean mutton, without fat or skin; add a tablespoonful of barley, a quart of cold water, and a teaspoonful of salt. Let it boil slowly for two hours. If rice be used, instead of barley, it need not be put in until half an hour before the broth is done.

Chicken-broth.

Cut up an old fowl, remove the skin, and break the bones with a mallet. Cover well with cold water and boil slowly for three hours. Salt to taste. A little rice or tapioca may be boiled with it, if desired. Skim off the fat and add a little parsley, if desired.

White Soup.

Add half a pint of boiled milk to an equal quantity of beef-tea and slightly thicken with flour. Some pieces of celery, or celery-seed, may be added to flavor, and strained out before serving.

Oyster-broth.

Cut into small pieces twenty-five oysters and put them in a chafing-dish; let them simmer gently for ten minutes at a moderate heat; skim, strain, add salt and pepper.

Clam-broth.

Take three large clams (having thoroughly cleansed the shells) and let them stand upon the stove until the shells begin to open. Drain out the liquor, add an equal quantity of boiling water, a teaspoonful of finely-pulverized cracker-crumbs, a little butter, and salt to taste.

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[1] This and some of the preceding recipes are from *The Trained Nurse* in an article on "The Food of the Sick," by Henry Hartshorne, M.D., LL.D., of Philadelphia.

Hot Clam-bouillon.

Small quantities of clam-bouillon may be conveniently and rapidly prepared by pouring about half an ounce of the preserved juice (Burnham's) into a cup and filling the latter to the brim with hot water. Some pepper may be added for the sake of flavor.

Oyster-soup.

Take a quart of milk and bring it to the boiling-point and skim it. As it boils add a tablespoonful of flour rubbed smooth with an equal quantity of butter, stirring it until the milk is thickened by the flour. Then add twenty-five or more oysters and bring to the boiling-point, and remove at once or the oysters will be tough. For seasoning, one or two allspice may be added, with pepper and salt.

Oysters Chafed.

Heat the chafing-dish and place in it a lump of butter; when hot, turn in the oysters and let them simmer for a few moments; remove, and add condiments to taste.

Rice-soup.

Take half a pint of chicken-stock and two tablespoonfuls of rice. Let them simmer together for two hours, then strain and add half a pint of boiling cream or milk, and salt to taste. Boil up at once and serve hot.

Flour-gruel.

Mix a teaspoonful of flour with milk enough to make a smooth paste, and stir into a quart of boiling milk. Boil for half an hour, being careful not to let it burn. Salt and strain.

Flour-soup.

In a skillet place a lump of butter, and, when melted, add, with a dredging-box, sufficient flour to cover it; when this is thoroughly browned by the heat add a cup of milk and water, and season with salt while boiling. Strain and serve hot. This and the preceding are useful in bowel disorders.

Flour-ball.

Moisten a pint of flour with a couple of ounces of cold water, and tie up in a ball, tightly, in a strong cloth. Slightly moisten the cloth and sprinkle it with flour, and boil for ten hours. Then take off the cloth and let the ball dry in a slow oven for ten hours more. It is then ready for use in making

Boiled-Flour Gruel.

Grate two tablespoonfuls of flour from the ball, mix it with cold water, to a smooth paste, and stir it into half a pint of boiling milk. Simmer about three minutes and sweeten. This is a good food for children while teething.[1]

Predigested Food.[2]—To the earnest advocacy of Dr. William Roberts, of Manchester, England, the profession is indebted for a clear conception of the great value of the partial digestion of food before administration. The process can be performed extemporaneously in any household, and is an inestimable boon in cases of profound debility of the digestive powers. The following directions are given by Dr. Roberts:—

Peptonized Milk.

A pint of milk is diluted with a quarter of a pint of water and heated to a temperature of about 140° F. (or the diluted milk may be divided into two equal portions, one of which may be heated to the boiling-point and then added to the

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[1] This and many of the preceding formulæ are based upon those contained in the excellent "Text-book of Nursing," by Clara S. Weeks. New York: D. Appleton & Co., 1885.

[2] For further observation on food, see author's papers on "Food and Diet in Health and Disease, including a Review of Many Prepared and Condensed Foods," *Medical Bulletin*, Jan., June, and July, 1892.

cold portion); the mixture will then be of the required temperature. Two or three teaspoonfuls of liquor pancreaticus, together with ten or twenty grains of bicarbonate of sodium (about half a small teaspoonful) are then mixed therewith. The mixture is then poured into a covered jug and the jug is placed in a warm situation, under a cosey, in order to keep up the heat. At the end of an hour, or an hour and a half, the product is boiled for two or three minutes. It can then be used like ordinary milk. By skimming the milk beforehand and restoring the cream after the final boiling, the product is rendered more palatable and more milk-like in appearance.

Peptonized Gruel.

A well-boiled, thick, and strong gruel, prepared from any of the farinaceous articles generally used for that purpose (wheaten flour, oatmeal, arrowroot, sago, pearl barley, etc.), is poured into a covered jug and allowed to cool to a temperature of about 140° F. Liquor pancreaticus is then added in the proportion of a tablespoonful to the pint of gruel and the jug is kept warm under a cosey, as before. At the end of a couple of hours the product is boiled and, finally, strained. This preparation is not generally acceptable to invalids, but may be used in conjunction with peptonized milk, as:—

Peptonized Milk-gruel.

First, a good, thick gruel is prepared from any of the farinaceous articles just mentioned. The gruel, while still boiling hot, is added to an equal quantity of cold milk. The mixture will have a temperature of about 125° F. To each pint of this mixture two or three teaspoonfuls of liquor pancreaticus and twenty grains of bicarbonate of sodium are added. It is then kept warm in a covered jug under a cosey for a couple of hours, and then boiled for a few minutes and strained. The bitterness of the digested milk is almost completely covered in the peptonized milk gruel.

Peptonized Soups, Jellies, and Blanc-manges.

In order to vary the regimen and increase its palatability, Dr. J. Milner Fothergill describes[1] other peptonized dishes which may be prepared. A soup may be made by using peptonized gruel, which is quite thin and watery, instead of simple water, for the purpose of extracting shins of beef and other materials employed for the preparation of soup. Jellies can be made by simply adding the due quantity of gelatin or isinglass to hot peptonized gruel, and flavoring the mixture according to taste. Blanc-manges may be made by treating peptonized milk in the same way and then adding cream. In preparing all these dishes the operation of peptonizing the gruel or the milk must be completed, even to the final boiling, before adding the stiffening ingredient.

Peptonized Beef-tea.

Half a pound of finely-minced lean beef is mixed with a pint of water and twenty grains of bicarbonate of sodium. This is simmered for an hour and a half. When it is cooled down to about 140° F., a tablespoonful of the liquor pancreaticus is added. The mixture is then kept warm under a cosey for two hours and occasionally shaken. At the end of this time the liquid portions are decanted and boiled for five minutes. Beef-tea prepared in this way is rich in peptone, and its nutritive value in regard to nitrogenized materials is about equivalent to that of milk. When seasoned with salt it is scarcely distinguishable in taste from ordinary beef-tea. As a convenient method of peptonizing milk, Messrs. Fairchild Brothers & Foster, of New York, have now on sale "peptonizing tubes," each of which contains sufficient extractum pancreatis to peptonize one pint of milk.

Peptonized Oysters, Milk-toast, etc.

The late Dr. N. A. Randolph, in a case of asthma which was aggravated by indigestion, found that, by treating stewed oysters, milk-toast, and other articles of diet for the sick in this manner, the patient was able to get along without any paroxysms as long as he continued the use of peptonized food. The same expedient might be useful in low fevers, dysentery, etc.

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[1] "Indigestion, Biliousness, and Gout in its Protean Aspects." Part I. By J. Milner Fothergill, M.D.

Koumiss.

Koumiss, or milk-wine, originally made by the Tartars by fermenting mares' milk, is now prepared on a large scale in this country from pure cows' milk. It is deservedly esteemed as a combined stimulant and nutrient, very beneficial in wasting conditions, and, from the carbonic acid which it contains, efficacious in allaying irritability of the stomach. Koumiss may be made at home, according to the following directions of the late Prof. S. W. Gross: "Dissolve half an ounce of grape-sugar in four ounces of water. Dissolve twenty grains of yeast-cake in four ounces of milk. Pour both into a quart bottle and fill nearly to the top with milk. Cork tightly, fastening the cork with wire. Put into a cool place and shake two or three times daily for three days. Keep for use no longer than six days. A champagne-tap introduced through the cork is necessary. Koumiss contains about 16 per cent. of alcohol."

Rectal Alimentation and Nutritive Enemata.—It sometimes becomes necessary to abandon for a time the usual route for the administration of food, as in cases of gastric ulcer, persistent vomiting, and athrepsia in infancy. Under such circumstances we may resort to the rectum, and introduce nutritive substances by injection. It is considered advisable to add a certain amount of pepsin or pancreatin to the prepared food in order to facilitate the formation of peptones and the absorption of albuminoids. Milk-punch and beef-essence or infusion may be used, with advantage, or sterilized milk, to which pancreatin and soda are added just before introduction into the bowel. Dr. Spencer has suggested nutrient suppositories made of beef chopped up, finely mixed with fresh pancreas or with pancreatic extract.

The quantity of fluid food used at each injection should not be more than 60 to 120 c.cm. (or f℥ii-iv), depending upon the capacity and toleration of the patient. In infants, from 15 to 30 c.cm. (or f℥ss-j) is the limit. Irritability of the rectum may be overcome by a preliminary irrigation with cold water, or the use of an opium suppository or laudanum injection. The nutritive enema may be repeated every four hours, and may constitute the sole reliance for nourishment during a period extending over several months.[1]

In Ewald's clinic every case of simple gastric ulcer is fed exclusively by the rectum for six days, with excellent results. The patients have been free from pain on the third day. The method has also proved of value in the differential diagnosis from neurotic cases with similar symptoms.

The introduction of normal salt solution into the rectum not only supplies water and salt to the blood, and increases intravascular tension, but also stimulates secretions, especially from the kidney. In fact, the use of salt-water enemata furnishes a valuable method of flushing out the kidneys. This is an important feature of the treatment after nephrotomy, nephrectomy, or nephropexy. In all cases in which ether is used as an anæsthetic, and there is diminution of the urinary secretion, this should be resorted to. In Dr. H. A. Kelly's private hospital it has been the custom, in all cases in which the kidney has been operated upon, to give one pint or more of normal salt solution by the rectum, every six, eight, or twelve hours, for several days after the operation.[2]

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[1] "Rectal Alimentation and Medication in Diseases of the Skin," by J. V. Shoemaker, "Transactions of the Ninth International Congress," vol. iv, p. 170.

[2] *American Practitioner and News*, Oct. 1, 1904.

PSYCHOTHERAPY; HYPNOTISM AND SUGGESTION; METALLOSCOPY AND METALLOTHERAPY.

Psychotherapeia (ψυχη and θεραπευω), "the treatment of diseases through the mind," plays a most important part in the ordinary every-day practice of medicine. The influence of the mind upon bodily functions is so great that every experienced, intelligent physician is glad to enlist so potent an auxiliary, to some extent at least, in his treatment of diseased conditions. The eminent Dr. Rush always made a point, wherever possible, of explaining the action of the medicine which he prescribed for a patient, who, being thus made acquainted with the expected results, himself unconsciously favored their occurrence by what is known as "expectant attention." The confidence that a doctor inspires is generally acknowledged to be a powerful aid to his therapeutics. His hearty greeting acts like a stimulating cordial upon the drooping spirits of his patient, who takes fresh courage from his cheerful presence. This power of influencing others so as to affect their mental state or physical condition has been known and practiced since the most remote period. In the early history of medicine, when the duties of physician and priest were combined in the same person, many superstitious rites and ceremonies were employed in the treatment of disease in order to impress the mind of the patient and favor his recovery. The practice of the royal touch for the king's evil, or scrofula, which continued in England up to the time of Queen Anne, is a later illustration, and the ancient custom of wearing amulets to ward off disease has not yet entirely disappeared from even the most civilized communities. The wearing of iron rings for rheumatism, amber beads to prevent croup, horse-chestnuts in the pocket to protect from gonorrhœa, or gold rings in the ears to cure epilepsy, and other superstitious observances are of the same character. On a larger scale, we observe the so-called faith-cure, or Christian science, which could only find supporters among persons absolutely ignorant of physiology and correspondingly credulous and superstitious. The only proper criticism upon the latter is that "it is not Christian, and decidedly not science."

In order properly to approach this subject the student should read Tuke's admirable essay, entitled "Illustrations of the Influence of the Mind on the Body in Health and Disease, designed to Elucidate the Action of the Imagination,"[1] and also Pettigrew's "Superstitions in Medicine Connected with the History and Practice of Medicine and Surgery,"[2] and, especially, the little work of Sir John Forbes, on "Nature and Art in the Cure of Disease," each of which is classical and should be part of the necessary course of reading for every candidate for the medical degree.

In every system of medicine practiced among rational beings the action of the mind is not to be overlooked or ignored. Medicines that are repulsive to the senses of the patient, and that are taken under protest, are likely to excite disgust and nausea even if they are not immediately rejected by the stomach. Such remedies, whenever possible, should be substituted by other pharmaceutical preparations having the same physiological action, but more agreeable to the palate. The latter form will not only be taken more faithfully by the patient, but he will be more ready to acknowledge that they are

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[1] London, 1884. Second edition.
[2] Philadelphia, 1844.

doing him good, whereas he is sure that the other will not benefit him and is anxious to discontinue it. It must be acknowledged, however, that unpalatable remedies sometimes afford a strong argument in favor of early recovery.

Hypnotism (ὕπνος, sleep), or artificial trance, is a condition accompanied by loss of consciousness and power of voluntary motion, but with preserved intelligence and the ability to perform muscular movements under the verbal directions of another person. Suggestion is the name given to the process of instructing the patient in this way to do certain things. The patient apparently surrenders entirely his individual will and volition, and becomes an automaton under the direction of the operator. It has been said that the effects may remain even after the hypnotic sleep has passed off, and that patients will proceed at an appointed time to perform certain actions, suggested to them while in the hypnotic sleep, of which they retain no recollection when awake. It has been positively asserted that subjects have been hypnotized and instructed, while in this condition, to go on a certain date to a named place and there commit a crime such as stealing a watch or attempting to kill a person with a knife, and that they have afterward obeyed the suggestion, which assumed the form of an uncontrollable impulse. The relation of this to medical jurisprudence is very evident, and at present it is attracting considerable attention. There is a therapeutic application, however, which deserves some consideration. In some neurotic disorders, characterized by pain, spasm, paralysis, or paræsthesia, it has been demonstrated that, by hypnotism and suggestion, these symptoms can be made to disappear either temporarily or permanently. The phenomena of transference, by which a symptom (pain, paralysis, contracture) is removed from one part of the body to another, or even from one patient to another, is also of much interest to the pathologist and clinician. The effects of certain remedies, it was even claimed by Luys, may be produced simply by suggestion, without administering them, but this was shown to be a fallacy by Dujardin-Beaumetz. Closely related to this subject is metalloscopy and so-called metallotherapy, which will be considered somewhat in detail at the conclusion of this section.

Dujardin-Beaumetz, in a lecture[1] on "Suggestion in Therapeutics," admirably summarized our knowledge of the medical relations of hypnotism. He traces it to the desire for the marvelous and mystical, which has always exerted a dominating influence upon the mind of man. The fakirs of India have employed it under one form or another, from time immemorial. The fakir, in truth, is a charmer,—that is, a practicer of suggestion,—and he develops in the individuals surrounding him phenomena of hypnotism and somnambulism. This also appeared in Europe under various forms, as the thaumaturgists, the demoniacs, the rosicrucians, and performers of miracles and of sorcery, which occupy so large a place in the history of the middle ages. At a later period we observe these practices assuming a scientific tendency; for, although the suggestive processes are always the same in character, whether performed by Paracelsus or Charcot, there is in our own day a desire to discover for the phenomena a scientific explanation. Paracelsus in the sixteenth century assumed the existence in man of a special animating principle to which he gave the name of animal magnetism. This explanation was adopted by his successors, Van Helmont, Mesmer, and

[1] *Bulletin Générale de Thérapeutique.*

others, under various names (od-force, mesmerism, etc.), and this doctrine of magnetism was professed by many believers. About sixty years ago (in 1842) Dr. James Braid, of Manchester, England, succeeded in modifying this opinion among scientific men, by showing that by the fixation of the vision and attention upon some object, usually a brilliant one, it was possible to provoke the same series of phenomena, which now received the name of Braidism, or hypnotism. For a long time afterward the facts reported by Braid failed to attract much attention, although reports were occasionally published from surgeons of operations performed during the hypnotic state. It is not until we come to the communications of Lasègue, in 1865; of Charles Richet, in 1875; and to the numerous studies by Charcot from 1869 to the present time, that we find a due recognition of the phenomena of hypnotism in their medical relations. Luys ascribes these phenomena to fascination, such as is produced by a revolving mirror which is moved rapidly before the eyes of the subject upon whom this procedure is employed. Whether caused by hypnotism, suggestion, or fascination, Dujardin-Beaumetz stated that a series of phenomena are produced in certain patients which may be summarized under three principal types:—

1. The cataleptic state.
2. The lethargic state.
3. The somnambulistic state.

The latter is the suggestive phase of hypnotism. Bernheim and Liébault admit six categories of such hypnotized patients. In all of them the will of the operator takes the place of that of the subject. In the beginning of this provoked slumber there is somnolence and heaviness, and the power of suggestion is feeble. It is, however, sufficient, for example, to prevent the patient from lifting his eyelids without the permission of the operator. In the first and second stages the patient may be acted upon after the manner of automatic phenomena; subsequently, in the further stages, we arrive at true suggestion, when the patient is related only to the hypnotizer, who makes him execute movements or suggests to him illusions or hallucinations. These nervous phenomena may vary in form in different subjects, and also in the same subject, and the results are also determined to a considerable degree by the expertness of the operator.

The means of evoking hypnosis, or the hypnotic sleep, are of the most varied character. For the passes of the magnetizers, Braid substituted fixation of the glance upon some object,—something brilliant, such as a bright button, or even the finger of the operator. At Charcot's clinic the sense of hearing is appealed to; the noise of a gong determines the hypnotic state as well as the production of a bright light. In a word, every sensorial impression may be utilized.

The Abbé Faria, in 1814, was the first to protest against the idea of a magnetic fluid and to affirm that the slumber of the hypnotized was produced by suggestion or by will. He fixed the glance of the subject, and showed the back of the uplifted hand; then he advanced several paces, and suddenly lowered his hand, ordering the subject to sleep. This is the method of hypnosis by suggestion which is adopted by the school of Nancy.

Dujardin-Beaumetz produced sleep by fixation of the gaze and occlusion of the eyes.

As for awakening the patient, this may be done in a number of ways. The usual method is to tell the subject to awake, raising the voice in a tone

of command. The same result may be obtained by breathing lightly upon the face of the hypnotized.

The clinical authority, from whom the foregoing has been quoted, classes patients, who are to be subjected to hypnotism as a therapeutic resource, into three classes: In the first class are the hysterics; in the second the neurasthenics, the ill balanced, the hypochondriacs, the nervous; finally, the third comprises all those suffering from organic affections with lesions, and in whom the nervous element plays only an absolutely secondary rôle. Suggestion, or hypnosis, has always produced its most positive effects in the first group. This group is very numerous, and includes men as well as women. Male hysteria occurs not alone among the well-to-do, but also in the laboring classes. On this soil flourish a number of pseudomaladies, which, in their manifestations, assume the form and course of diseases of organs, producing gastric or pulmonary hysteria, for instance, which closely resemble organic affections. The characteristic feature of all of these manifestations is that they can be made to disappear by hypnotism and suggestion.

It is among this class of suggestionable hysterics that we find such brilliant examples of successful hypnotic anæsthesia, during which tedious surgical operations may be performed or accouchement accomplished. A large number of cases have been reported by surgeons of the use of the hypnotic sleep since Esdaile published his records of several thousand cases in India. Owing to its simplicity, it is admirably adapted to short operations, such as extracting teeth; but major operations have also been performed under its influence by Esdaile and others.

The second group of cases—the neurasthenic, the hypochondriacal, and the unemployed—are less influenced by suggestion. With such neuropathics the personal influence of the physician and the assurance with which he prescribes his remedies have more effect than the remedy itself. Here lies the success of little particolored granules or miniature powders, "over which certain physicians make magnetic passes before administering them"; and, we might add, here is the secret of the financial success of some men whose assurance is only equaled by their ignorance.

As to the third group, it must be stated that, in the presence of actual lesion, suggestion has a very limited field. Pain may be removed for the time and the general state improved by the assurance of an early recovery, the effects of a remedy may be enhanced by expectant attention. In fact "every new remedy has a phase of success which belongs to the domain of suggestion."

The proportion of patients who are amenable to suggestion is set down very differently by various authorities. Dujardin-Beaumetz claimed that the number has been very much overestimated. Even among the first class of hysterics, who are the most susceptible to this mode of treatment, he finds a certain number not hypnotizable; or, at least, there are, among hysterical subjects, many affections which cannot be ameliorated by suggestion; so that the actual proportion of those curable by this method is much smaller than has been claimed.

The International Congress of Hypnotism, held at Paris in 1891, is an illustration of the growth of this therapeutic method of late years and its present magnitude. Dr. Ernest Hart, in commenting upon the schools and doctrines of hypnotism, pointed to the published addresses

and discussions at this Congress, which he holds are sufficient to show that all is not yet clear, even as to the nature, not to say the grouping, of the phenomena which are included under the name of hypnotism. The school of La Salpêtrière maintains that, in what it calls *le grande hypnotisme*, there are always physical phenomena which arise independently of any suggestion; while the school of Nancy holds that these phenomena are superadded, and only make their appearance as the result of a suggestion, voluntary or not. It was Charcot who put the whole subject upon a scientific basis, and who definitely disposed of the claims of animal magnetism. Following him are a number of able observers in different countries of Europe who have contributed greatly toward firmly establishing hypnotism within the domains of science. *Le grande hypnotisme* constitutes the most perfect and typical form of hypnotism. The whole doctrine of Charcot may be expressed in the following propositions of his favorite pupil, Babinski: First, the physical characters observed in the hypnotism of certain subjects allow the absence of simulation to be affirmed; secondly, hypnotic phenomena may effect a special grouping in three distinct states; thirdly, the physical phenomena of hypnotism may be developed independently of any suggestion; fourthly, hypnotism in its most perfect forms must be recognized as a pathological or diseased condition. On the other hand, the doctrine of the school of Nancy may be summed up in the single word "suggestion." M. Bernheim offers the following definition: "The hypnotic state is that peculiar, induced psychical state which augments, in divers degrees, suggestibility; that is to say, the aptitude to be influenced by an idea accepted by the brain and to realize it." The school of the Salpêtrière holds that, in any case, healthy, well-balanced individuals cannot be hypnotized; and that those who are capable of undergoing special psychical transformation are persons who have a neuropathic constitution. This seems like an important fact to establish, and indirectly confirms the opinion already quoted by Dujardin-Beaumetz that hysterical subjects furnish the greater number of successful cases.

Hypnotism may give rise to accidents in certain cases, and, after hearing an address by Dr. Ladame, the Congress demanded that public displays of it should be forbidden, and that it should be considered as a therapeutic method and reserved for physicians alone. At Nancy, the doctrine is upheld that crime may be committed by a person under the influence of suggestion as the result of such influence. Dr. Gilles de la Tourette declared his belief that the only possible crime which might be committed is on the person hypnotized. Hypnotism is directly dangerous because it may end in completely upsetting the intelligence of the subject, and indirectly by the excessive influence which it gives to the operator over the subject, of which the limits have not been determined. A death has been ascribed to hypnotism. The accident happened to a young Hungarian lady, who was hypnotized by a layman with a view of obtaining information by "clairvoyance." The patient seemed exhausted and after replying to a question "she fell from her chair with a hoarse cry; her tongue protruded from her mouth and she became collapsed. Her head was lowered, clothing loosened, artificial respirations performed after Sylvester's method, and ether injections given; later she was wrapped in blankets, but she died almost in a few seconds in spite of all." It was considered, after an autopsy, that death was caused by acute anæmia of the brain, incident to the hypnotic state,

with syncope and heart-failure. It may, indeed, be questioned whether the unfortunate result was directly due to hypnotism, since Krafft-Ebing writes that the victim was probably so constituted that death might have been hastened when awake by a violent psychical force. At all events, the possibility of such an occurrence should enjoin caution.[1] Hypnotism may influence the actions of hysterical subjects, but it is difficult to ascertain up to what point this proceeding can, with advantage, be employed to correct the morals of children or evilly-disposed or criminal persons. Doubt is still very permissible on this point, notwithstanding the long list of observations which are found in Bernheim's book. Beyond doubt, however, hypnotism is capable of rendering services in the study of experimental psychology, and much has already been accomplished in this direction.

Hypnotism in General Practice.—It is a proper question to ask: How far may hypnotism be utilized by the general practitioner? In the first place, it is a method which savors of charlatanism, and in a large number of cases is not applicable. As Dujardin-Beaumetz has shown, it is serviceable principally among hysterical subjects. In other words, it is likely to be an experiment doomed to failure in the very class of patients whose esteem is most desired,—the intelligent, well-balanced, and sensible ones. It is not surprising, therefore, that it has been avoided by the majority of physicians. Nevertheless, in selected cases, it can be resorted to as a therapeutic expedient with brilliant results. Dr. Joseph Collins, of New York, reports five cases in the *New England Medical Monthly* (April, 1892), and directs attention to the fact that in suggestion we have a valuable corrective agency for children who have acquired or inherited criminal tendencies. In the cure of chronic inebriates it certainly deserves a trial. In some cases of insanity the outlook for suggestion is promising. It is among functional nervous diseases that we find the greatest field for this measure. "It is for hyperæsthesia, the various paralyses, contractures, spasms, convulsions, and other nervous ailments of non-demonstrable organic lesions where it has its greatest use. Supposed diseases, dread of diseases, disorders of digestion, and other functions will, undoubtedly, in many instances, disappear under the influence of mental suggestion."

The susceptibility of children to hypnotism was carefully considered by Dr. Edgar Bérillon in a paper[2] before the Paris Society of Hypnology. It is a matter both of scientific and medico-legal importance. The author claims that 80 per cent. of children, from every class of society, may be hypnotized at the first or second trial. The most singular part is that children with the most marked hereditary nervous taint are the most difficult to hypnotize. Epileptics are highly susceptible. The author recommends that suggestion be made use of in the treatment of such conditions as insomnia, night-terrors, kleptomania, onanism, and other vicious habits. Bérillon has instituted in Paris a psycho-physiological institute for the treatment of diseases by hypnotism. He employs small mirrors which are made to rotate by clock-work, sometimes substituting a magnesium lamp or other bright, glittering object. The patient is placed in a comfortable posture in a chair and directed to look fixedly at the object for ten or twenty minutes. If sleep does not come, then the patient is sent away and told

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[1] *Journal of the American Medical Association*, Oct. 27, 1894.
[2] *Gazette Médicale*, July 25, 1891.

to return another day. In cases which do not yield to this method, a vibrating coronet made of thin bands of metal is placed upon the head, and adjusted by means of a nut to produce slight pressure on the brow. A branch projects from the coronet and is made to rest upon one eyelid. In order to waken the patient, it is generally sufficient to blow lightly upon the eyes and command them to wake up. In dipsomania, neurasthenia, and hysteria this method has been very successful.

In his address before the Colorado State Medical Society, the late Dr. J. T. Eskridge reviewed[1] the entire subject in a masterly manner. He declared that by suggestions during the stage of hypnosis he had been able to improve digestion, increase the appetite, and relieve constipation. As a rule, tired and nervous feelings can be abolished by hypnotic suggestion. Slight despondency may be overcome and raised to hopefulness. Headache, if not too severe, is readily relieved; but he had not succeeded in relieving acute pain, such as toothache or trigeminal neuralgia. Stammering has been treated with marked success. Morbid fear of insecurity may be beneficially influenced. With regard to bad habits, Dr. Eskridge stated that in no case had he succeeded in breaking up any bad habit except by repeated hypnotic suggestion. Experience has taught that the impressions made by hypnotic suggestion are not very permanent at first, and are only made so by repeated suggestion, extending over a considerable length of time. Dr. Eskridge offered the following as the conclusions of his study of the subject:—

1. That hypnotism is real, subjective, and disassociated from any mysterious influence formerly supposed to be exerted by the hypnotist over the subject.

2. That its therapeutic value depends upon the mental impressions made during hypnosis, the latter rendering one more impressionable at the time.

3. That much that is accomplished by the aid of hypnotism may be obtained by repeated impressions without hypnosis.

4. That hypnotism may be attended by certain dangers to the hypnotist, the subject, and the community; but that, so far as the reputation of the hypnotist or the health of the subject is concerned, proper precautions will enable us to prevent any untoward effects, leaving numerous dangers of a medico-legal nature to be guarded against when hypnotism is practiced by unprincipled persons.

5. That whether or not the therapeutic value of hypnotism is greater than the dangers that cannot be prevented from its practice is not determined, and should receive careful attention at the hands of competent investigators, whose minds are not likely to be unduly biased by skepticism or enthusiasm.

6. That no one should be allowed to hypnotize without a license from the State to employ hypnotism.

7. That the practice of hypnotism should be limited to physicians and other scientific investigators.

8. That no one of questionable reputation should be given a license to hypnotize, and anyone so licensed should forfeit it on being convicted of crime.

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[1] *New York Medical Journal*, Aug. 1, 1891.

Dr. C. H. Hughes,[1] of St. Louis, in a discussion before the New York Medico-Legal Society, declared that public exhibitions of hypnotism should be prohibited by law. Hypnosis, according to him, is an abnormal function of the brain, and the practice of inducing it should not be encouraged when the subjects were persons who were very impressionable. Dr. Nolan[2] reported a case of insanity following hypnotism in a soldier, the victim of a neurosis produced by debauchery. Profound hypnosis was rapidly induced by gazing at a bright object. From this state the patient did not completely emerge until the lapse of nearly four months. Throughout this period of stupor the patient was disturbed by a recurring visual hallucination of an old hag, who seemed to rush toward him. Dr. Julius Solon[3] also reported a case where an amateur at a friend's house volunteered to hypnotize a fellow-visitor, and, after two trials, succeeded so well that the subject grew extremely excited, lost the power of speech, and then passed into a condition of catalepsy; subsequently he had severe convulsions. He had been hypnotized by being made to look at a diamond ring, and afterward the sight of anything glittering threw him into a state of violent excitement. He went into a condition of grave hysteria, with maniacal excitement, during which he had numerous convulsions; in the intervals he would sing over, song after song, apparently all the songs he knew, and as long as one remained unsung nothing could stop him. At the end of a fortnight he had an attack of fever, followed by copious perspiration and dyspnœa; a few days later he had a similar attack, and after this he declared himself well. From first to last he was seriously ill for three weeks. The cause of the fever was ascribed by his physician to inflammation of the anterior part of the brain.

Dr. Moll, of Berlin, author of a book on hypnotism in the "Contemporary Science Series," speaks favorably of suggestion in childbirth, where it may be used always without damage, and sometimes with most signal efficacy in relieving suffering. Dr. Moll attaches the greatest value to this as a means of breaking up habits, such as morphinomania, drunkenness, etc., which the patient is no longer able to control.

Dr. Hamilton Osgood[4] also speaks favorably of hypnotism, and believes that the assertions of the leading hypnotizers of Europe, with reference to the harmlessness of this treatment, when intelligently applied, are true. The possibility of idiosyncrasy must be always borne in mind, however, although Osgood has never met it in any of the patients whom he has hypnotized, nor have any, according to him, who confine themselves to the Nancy method. The dangers lie rather in insufficient technical knowledge than in hypnotism itself, and Osgood joins Moll and others in urging the abstaining from suggestions which do not accord with the normal functions of the organism.

Dr. J. Leonard Corning,[5] of New York, in discussing the therapeutic value of hypnotism, declares that the rôle it is destined to play is a subor-

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[1] *British Medical Journal*, April 11, 1891.,
[2] *Journal of Mental Science*; *Druggists' Circular*, May, 1891.
[3] *New York Medical Journal*, March 14, 1891.
[4] *Boston Medical and Surgical Journal*, 1891.
[5] *Journal of American Medical Association*, Dec. 13, 1890; from the *Medical Record*.

dinate one; it is a collateral expedient, invoked largely with the view of rendering the patient more tractable and amenable to other elements in the plan of treatment.

It should be borne in mind, as insisted upon by the late Dr. George M. Beard, that the phenomena of suggestion are not caused by superior will-power of the hypnotizer. There is no transfer of mental force; there is merely a passive condition of the subject, which makes him act automatically, in a manner suggested by another person, who has no power or control beyond the mere suggestion of the idea.

Hypnotism and the law has been the subject of two essays read before the Medico-Legal Society of New York,—one by Clark Bell, Esq., and one by John J. Reese, M.D.[1] The position taken by the former is that the bar and judiciary are in duty bound carefully and calmly to investigate, and, so far as possible, define the phenomena and place its true limitations regarding personal and certainly criminal responsibility. He would advocate restricting its use to qualified investigators, but would oppose limiting it to medical men. Dr. Reese regards it as a true pathological state, even though unaccompanied by any demonstrable change of structure. There should be, in his opinion, legal surveillance over private experiments and public exhibitions.

In mental disease Dr. Voisin[2] has had good results in conquering hallucinations, overcoming delusions, and in quieting acute mania. He was able to induce hypnosis in about 10 per cent. of his patients. Raulin narrates the case of a girl, aged 18 years, with an hysterical laugh of four months' duration, which began during the inhalation of chloroform for some slight operation. The girl was easily cured by being hypnotized and told to forget her inclination to laugh.

The editorial in the *Medical News* (October 10, 1891), on the therapeutic value of hypnotism, casts some doubt upon the advisability of substituting one neurosis for another, and suggests a strong relationship between experimental hypnotism and human vivisection. "We must have a better psychology and an infinitely more perfect pathology and pathogeny of psychical disease before we shall be capable of intelligent use of hypnotic control and suggestion as justifiable methods of cure." Dujardin-Beaumetz, in the lecture previously referred to, sums up the value of this method in the statement that "psychotherapy will never constitute more than an exceptional resource in the practice of our art, if we would limit it to the practice of hypnotism, properly so called," since there will always remain a large pathological group of organic affections against which we must employ special medication, and in which hypnotism can never play any rôle. "To suppose, for a single instant, that it would be possible, by mere affirmation, to cause the disappearance of the entire train of morbid symptoms is an illusion, and, worse, an error." Ernest Hart[3] very plainly summed up the whole matter, as follows:—

"Hypnotism is a pathological modification of the nervous system, which always indicates that the subject belongs to a neuropathic class. The com-

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[1] *Medico-legal Journal*, March and Sept., 1891.

[2] "Proceedings of Congress of Experimental Hypnotism, 1889." *Boston Medical and Surgical Journal*, Sept. 5, 1889.

[3] *British Medical Journal*, March 28, 1891.

plete and typical form of hypnotism described by Charcot is rare. Suggestion plays a considerable part in hypnotic phenomena, but there are somatic phenomena which are independent of it. Hypnotism may frequently be dangerous, and very rarely useful. It may be the cause of crime, or of mental disorder; it can really cure no disease not more easily curable by simpler and less dangerous methods. A considerable number of facts attributed to it which have most impressed the public imagination, such as the actions of medicines at a distance, the so-called telepathic communications, or communications made without speech, and the clairvoyant phenomena sometimes described, are mere errors of experiment arising from insufficient precautions and a too vivid imagination. Precisely those phenomena which have been most publicly talked about and excited most interest in 'psychical circles,' so called, are the least real. The hopes which the therapeutic hypnotist aroused have not been realized, and any expectations of producing by hypnotic methods any desirable moral or mental effect rest upon a totally inadequate basis of fact, and are far from being promising." Dr. Hart, in his monograph on "Hypnotism, Mesmerism, and the New Witchcraft," alludes to the dangers which may arise from an abuse of hypnotic influence, and calls attention to its actual alliance, in many cases, with humbug and fraud. He demonstrates that neurotic individuals have been trained for purposes of exhibition and so-called scientific experimentation. John R. Rose[1] gives the four rules formulated by Bernheim and Beaunis, which should always guide one in the application of hypnotism to the treatment of all diseases: "Never use hypnotism without the consent of the subject or the legal guardian. Never hypnotize except in the presence of a third party, who represents the subject. Never make suggestions without the patient's consent, excepting those necessary to effect a cure. Never use authority over a patient to secure his consent, if you have reason to expect disagreeable results from the experiment."

Metalloscopy and Metallotherapy.—The possibility of affecting bodily functions by the near approximation to the surface, or actual contact, of various metals has been a belief of mankind from a very remote period, and doubtless the phenomena exhibited by magnetic iron-ore had much to do with giving it something like a foundation in fact. In the history of this subject the name of Dr. Perkins, of Connecticut, will always occupy a prominent place, similar to that of Paracelsus in the early development of hypnotism, and the parallel is not an unjust one to the American. Perkins arranged a combination of metals in the form of a cylinder which could be grasped in the hand or passed over the surface of the body. By the application of these "tractors," as they were called, the morbid process was believed to be drawn out; he applied them with remarkable results, and many certificates of cures were obtained. This method had such success here that it was introduced into England, where it was received with great enthusiasm. It became at once very popular. Crowds of all classes resorted to the Perkinsian Institute, and wealth poured into the coffers of the shrewd proprietor, until Dr. Haygarth opened an opposition institution, and demonstrated to the world that he could obtain equally marvelous results from imitation tractors made of wood. In other words, Perkins's method was

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[1] *Journal of the American Medical Association*, May 20, 1899.

not metallotherapy, properly speaking, but an illustration of the influence of the mind over the body and of the curative effect of the imagination. Modern metalloscopy and metallotherapy are further illustrations, in all probability, of the action of this potent therapeutic adjunct under a more scientific dress.

Dr. Burq, in an inaugural thesis in 1851, called professional attention to the curative effects of metals in the form of plates, when applied to the skin in cases of paralyses of motion or of sensibility occurring in hysteria. The same metal is not applicable to all cases,—one being benefited by silver, another by gold, copper, or some other metal. He claimed that the internal administration of the appropriate metal to the given case would likewise produce favorable results. The detection and determination of the particular metal appropriate to each individual he denominated "metalloscopy," and the use of metals in this way "metallotherapy." This is quite different from the external use of magnets, to which attention has already been directed. Among the phenomena claimed by Burq to be produced by a piece of metal, such as a coin, properly selected according to the special sensibility of the subject, when placed in contact with the skin, is return of normal sensibility in permanent hemianæsthesia (hysterical) in from ten to twenty minutes, through a space of some extent above and below the point of application. Numbness, tingling, and other disorders of sensation precede the return of sensibility in the area immediately adjacent to the metal, and this gradually extends until the whole side returns to the normal. At the same time an elevation of the temperature recognizable by the thermometer and an increase of muscular power takes place. Where sight, hearing, taste, and smell are also in a condition of anæsthesia, as the general sensibility is restored these functions also become normal. A commission appointed by the Paris Academy, with Charcot at its head, having been appointed to examine into their claims for metallotherapy, confirmed them, and added what is known as "the phenomenon of transfer," by which is meant that with the restoration of normal sensibility upon the affected side there is a decline, to a greater or less degree, of the sensation of the corresponding area upon the opposite side. The phenomenon observed and the results obtained by the commission were of such a positive character that Charcot was led to ascribe them to electric currents stimulated by the contact with the metal. Such currents could only be an exaltation of the normal intercapillary electrical phenomena, since one metal could not originate an electric current outside of the body even when in contact with it. Professor Westphal, of Berlin, after a careful investigation of the subject, published his results, which, on the whole, were corroborative of those of Charcot and Burq. Dr. Hughes Bennett obtained equally striking results from other substances than metals.

The method of application is to select disks, or large coins, or pieces of wood coated with metal, and apply them to the affected limb either as a bracelet or a single plate kept in position with a bandage. The effects follow in a few minutes, so that experiment will readily determine which metal is to be used. As the rule, an individual is susceptible to one metal only. The order of usefulness is: iron, copper, gold, silver, tin, platinum.

Besides hemianæsthesia or paralysis of hysterical subjects, cures of writers' cramp, chorea, and neuralgia have been reported. When the metal to which the patient is sensitive is discovered, it is sagely recommended to

continue the treatment by the internal use of a salt of the same metal. In giving this advice Bartholow applied Burq's practice, already referred to.

The attentive student of the preceding section on hypnotism and suggestion will find a sufficient and fully-scientific reason for the above phenomena, without invoking any mysterious or occult influence of metals in the treatment of disease, other than in the sense in which Burton, in his celebrated "Anatomy of Melancholy," applies to metallotherapy in his observation to the effect that gold is a potent remedy for lowness of spirits.

Within the last few years the subject of metallotherapy has almost entirely disappeared from medical journals, and is omitted from our principal text-books.

HEAT AND COLD.

Heat, as measured by the thermometer, is a purely relative term. Living human beings have a normal standard of heat furnished by the surface temperature of the body, which varies a little at different points, but may be roughly stated to be about 100° (F.), or a little less (98.4° to 98.6° in the axilla, a fraction higher in the mouth or rectum). In certain states of the system this may be exceeded by as much as ten or twenty degrees, and, if this continues for a greater or shorter period, the patient is commonly said to have fever, or pyrexia (πῦρ, fire). The bodily temperature, on the other hand, may fall below the standard in collapse, coma from alcohol, loss of blood, starvation, or cancer. Vasomotor paralysis with dilatation of the blood-vessels is sometimes the cause of notable loss of heat after severe injuries of the upper portion of the spine. In sclerema neonatorum Dr. Bäumler[1] has observed a temperature as low as 71.6° F. (22° C.).

Cold may be defined as a lower degree of temperature than that which is normal to the human body. Absolute cold would be a condition entirely free from sensible heat; it is estimated at several hundred degrees (—459 degrees) below zero. Cold is unknown to us, practically, and by this term, therefore, we mean simply lower degree of heat. Articles which, when applied to the surface, abstract more or less heat from it, are said to be cold; those which, on the contrary, communicate heat to the body, are said to be hot.

This fact is of considerable service in therapeutics, since we are able, to a certain extent, to regulate the bodily temperature by means of external applications. For convenience we will treat of them under two heads, viz.: (1) the effects of hot applications or external heat, and (2) the effects of abstraction of heat by relatively cold applications.

I. Heat as a Remedy.

Physiological Effects of Hot Applications.—The primary effect of heat, when locally applied to the human body, is that of an excitant or stimulant. If the temperature be sufficiently high,—say, that of boiling water,—irritation will be so great as to lead to serous effusion between the layers of the epidermis, the external squamous layer being thereby elevated and a

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[1] Quain's "Dictionary of Medicine," p. 1599.

blister formed, followed by more or less local inflammation. If the temperature be even greater, necrosis of the tissues will take place, to a greater or less extent, followed by sloughing. The application of higher degrees of heat, as by the actual cautery, is attended by shriveling and combustion of soft parts, followed by decomposition, suppuration, and necrosis. More or less pain is caused by the application of anything to the surface the temperature of which is much higher than that of the body. After the application of heat the electric currents in the sensory nerves are reduced, or even destroyed. Heat may, therefore, act as a sedative in painful affections of the nerves. Moderate heat, applied generally to the surface, produces important physiological effects, which have already been referred to in discussing the effects of warm and hot baths. Dry heat is better borne than moist heat, and glass-workers, metal-founders, stokers, and others constantly carry on work at a temperature much greater than that of the human body. It is recorded of Chabert, "the Fire King," that he frequently exposed himself to a temperature of 400° to 600° F. without injury; and, in the Turkish bath, the temperature of the hot room is ordinarily from 140° to 160° F.

The effects of exposure to an elevated temperature in dry hot air, for a short time,—from half an hour to an hour,—are: a slight rise in bodily temperature and an increased rate both of pulse and respiration, but more of the former than of the latter. The capillary system becomes congested, and the arterial tension is increased as a result of greater rapidity of the heart's action. The action of the kidneys and skin is more marked, and the proportions of chlorides and urea are increased. The skin becomes bathed in perspiration, which, by its evaporation, keeps the bodily temperature down nearly to normal. In moist air this evaporation does not so readily take place, and much lower degrees of heat speedily become unsupportable. It is on days when the humidity is great that sun-stroke is more apt to happen, since, under such circumstances, the bodily temperature rises until the brain is affected by the overheated blood, and coma or convulsions ensue. This is more likely to occur if the person affected has been engaged in active muscular effort, or was under the influence of alcohol at the time of exposure.

Therapeutical Applications of Heat.—General or local measures may be employed to exert thermic influences upon the body. The general applications may be made by means of baths of various kinds, including the Russian or steam bath, and the hot-air bath, which have been already referred to. A variety of the latter is known as **heliotherapy**, or the sun-bath, which has a powerful effect upon nutrition, and in some chronic forms of disease it has curative effects scarcely obtainable in any other manner. It may be taken in a warm room, with the clothing removed from the portion of the body to be acted upon, or the entire body may be exposed to the rays of the sun for a period of half an hour to an hour; or the body may be covered with clothing, and the warmth of the sun principally utilized. That the sun's rays exert a powerful influence is shown by the acute dermatitis which is caused by exposure to the sun while boating or swimming; even blistering is produced, in severe cases, besides discolorations of the skin (tanning and freckles). The direct rays of the sun, concentrated by a double-convex lens, have all the effects of the actual cautery, and may be thus employed to destroy epithelioma, or small growths in the skin.

Local applications of heat may be made by means of special apparatus for the dry hot-air treatment, consisting of metal cases, usually heated by electric lamps, or by gas-flame externally applied, also by hot-water bags, sand-bags, bricks, etc.,[1] or by cataplasms, fomentations, or local baths.

Boeckel has shown that the virulence of chancroid is destroyed by a temperature from 40° to 42° C. (104° to 107.6° F.). In accordance with this observation, Welander has made use of heat with excellent and rapid effect in cases of chancroids and buboes. The heat was applied by means of leaden coils connected at one end with a reservoir of water at a temperature of 50° to 52° C. (122° to 125.6° F.) and at the other with a waste-vessel beneath the bed. The pipes are bent to correspond to the form and locality of the ulcer, and are covered with a layer of moist cotton before application. In passing through the tubes the temperature of the water is reduced to 40° or 42° C.

The general application of heat is useful where the body has become chilled, or there is collapse, owing to loss of blood, or shock after an injury; also in alcoholic intoxication. The patient may be covered with blankets, brought close around the neck, but lifted up from the body into a sort of a low tent, into which hot air may be carried from an alcohol-lamp or small baskets, containing hot bricks or sad-irons, may be ranged by the side of the patient. Circulation of the blood may be assisted by rubbing the patient's limbs toward the trunk. The hot bath has already been considered. Baths of hot sand and mud-baths are used in Europe for the cure of rheumatism, paralysis, and spasmodic contractures of muscles. In collapse of cholera, and in restoring persons apparently drowned, heat is of great importance. Special forms of apparatus, consisting of large boxes of sheet-iron lined with asbestos, which can be heated by the flame of lamps or gas, so as to raise the temperature to 300° or 400° F., have been made of various shapes so as to expose a portion of the human body to this elevated temperature. As this treatment is especially used for the treatment of chronic synovitis and painful and inflamed joints, the apparatus in most frequent demand is that into which the affected arm or leg may be introduced. In traumatic, rheumatic, and gouty arthritis the results have been most successful. The treatment usually lasts for one hour, and is given daily or every second day. The effects are not only local in relief from pain, swelling, and stiffness, but, as the patient generally perspires profusely while taking the local bath, he has the benefit of a general hot-air bath, as well as the local effects of the high temperature, which, in many cases, are remarkable. The electric lamp apparatus is very effective and convenient.

Dr. E. S. Morse, of Ashtabula, Ohio, resorted successfully to the topical application of dry hot air in a case of senile gangrene. The patient, two of whose toes had been amputated, was 79 years of age, cachectic, the subject of mitral disease, and had symptoms of septicæmia. The hot-air treatment was given twice daily for two weeks, by which time the wounds were healed.

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[1] Professor Tarnier has used warmth with remarkable results in saving the lives of prematurely born or weak infants. He uses a box heated with hot-water bottles, the heat being regulated with the thermometer. This apparatus is called a *couveuse*, and is in general use in maternities and foundling asylums.

It has been experimentally shown that the paroxysms of idiopathic epilepsy are preceded and accompanied by toxicity of the blood, urine, gastric juice, and sweat, and Cabitt states that the hot-air bath is an excellent means of preventing or ameliorating epileptic attacks.

Topical applications of heat are called for in cases of pain, local congestions, or spasms, and to allay irritability by acting as a counter-irritant. Thus, in neuralgia or toothache, the application of heat with a rubber hot-water bag, or with the hop-bag moistened with hot whisky, is often of signal service. In a similar manner colic of various kinds—colalgia, gall-stone colic, nephritic colic—is promptly relieved by hot applications, either dry or moist. In pneumonia and pleurisy hot poultices relieve pain and congestion, favor perspiration, and moderate the fever and cough. Hot applications will often arrest superficial inflammation if applied early, and in later stages they favor suppuration and separation of the necrosed tissues from the living. A hot-water bag applied to the spine, in the dorsal region, will stimulate the spinal centres and check uterine hæmorrhage. In rheumatic inflammation of joints, subacute in character, the alternate application of hot and cold applications causes rapid absorption of the effusion. The many uses of poultices and the hot-water bag cannot even be enumerated here, but enough has been mentioned to indicate their therapeutic value. By combination of mustard or spices with a cataplasm or poultice, the counter-irritant effect is greatly increased; but this is beyond the borders of the subject of heat by itself, which is now under discussion. The higher degrees of heat are used as escharotics.

The Chinese method of raising a blister is to immerse a plate of metal, of the corresponding size, in boiling water. When thoroughly heated, it is taken out and applied directly to the skin. As this is very painful, it is not to be compared with the ordinary method, and is not likely to come into favor here with the profession or public. The actual cautery is a surgical instrument, but it may be utilized in medicine in the treatment of chronic rheumatic or tubercular inflammation of joints. In sciatica the surface over the course of the nerve may be lightly touched by the actual cautery, to produce a counter-irritant effect, or a piece of flannel overlaid by hardware paper may be placed along the limb over the painful area and a hot sad-iron passed lightly over the surface.

II. Effects of Abstraction of Heat by Cold Applications.

Physiological Effects of Cold.—Cold applied to the living body produces some congestion of the superficial blood-vessels, soon followed by their rapid and extreme contraction and lowering of the surface temperature. If the exposure has been moderate, reaction follows, with redilatation of the capillaries, augmented energy of the circulation, and restoration of the normal heat. In weak or debilitated people reaction is slow or may not appear at all; but there is a more or less lengthy period of vital depression, accompanied by enfeebled nutrition, and followed by a slow recovery. Prolonged exposure to a low temperature may induce not only local and temporary vascular syncope, but local or even general devitalization; beyond this point only the physical and chemical effects of cold continue. Complete freezing of a tissue or organ is never followed by complete restoration of function, as the devitalized portion is necrosed and sloughs off. This condition is

known as frost-bite and gangrene. Less intense cold may lead to a tendency to permanent dilatation of the capillaries of the skin, associated with paræsthesia and at times pruritus. This is known as **pernio**, or chilblain, and causes much annoyance, to children especially. The application of carbolized lotions or petrolatum with carbolic acid (3 to 5 per cent.) affords much relief. Frost-bite may lead to loss of toes or fingers, or even require amputation of portions of the feet, after severe exposure. Death from exposure to cold is attended by shriveling and lividity of the skin, muscular weakness and rigidity, with mental symptoms, drowsiness, confusion, and coma. These symptoms have been mistaken for the effects of alcohol, and the error is more likely if the subject had been indulging in alcohol before his exposure. The **post-mortem appearances** consist in a waxy anæmia of the surface, varied by bright-red patches on the more exposed portions of the body. Internal organs much congested. The reddish-brown stains along the course of the superficial blood-vessels are due to disintegration of the blood-cells by the cold and diffusion of the coloring matter through the vascular walls (C. E. Shelly[1]).

In treating a patient who has been rendered unconscious by extreme cold, the point to be borne in mind is that the restoration of heat should not be rapid, but gradual. The patient should be stripped of clothing and put between blankets, in a cold room; the surface should be stimulated by gentle friction, using snow or ice-water to frozen parts, at first, and afterward dry flannel. The bladder should be emptied by catheter, and small quantities of hot broth, tea, coffee, or beef-tea may be administered as soon as the patient can swallow. After reaction is established, but not at first, some hot toddy may be given. Nutritive enemata may be administered, and the patient carefully nursed, as recovery is usually slow.

Effects of Cold on Bacteria.—It has been shown, with regard to pathogenic bacteria, that their vitality is only suspended, and not destroyed, by extreme cold. For instance, the bacteria of yellow fever, typhoid fever, and the plague bacillus are checked in their growth, but not killed, by freezing.

Therapeutics of Cold.—Two classes of cases are benefited by the application of dressings, or other agents, of low temperature. These are: where it is desired to have the primary and secondary physiological effects upon nerves, blood-vessels, and cells of the part, and, secondly, where the physical effect is principally sought after through the abstraction of heat or the lowering of abnormal temperature. With regard to the latter, it may be said that nervous symptoms of various kinds are produced by an abnormal temperature of the blood as it flows through the vessels of the brain, and in what Dr. H. C. Wood terms "thermic fever" the principal object of treatment is to protect the brain-centres by abstraction of heat from the blood. In the treatment of pyrexia, cold is used as an antipyretic by numerous methods: the cold bath, wet pack, sponging of the surface, or by the water-bed or coils of rubber tubing. Cold-water enemata in typhoid fever have some influence upon the temperature, and tend to make the patient more comfortable.

Cold is not only **antipyretic**, but may be applied as a **tonic** and **stimulant**, reaction being hastened by brisk friction. It also acts as a sedative and anodyne by abstraction of heat and lessening the conductivity of nerve-

[1] "Dictionary of Practical Medicine," edited by J. K. Fowler, 1890.

trunks; it may even be a local **anæsthetic**; but care should be taken not to freeze the part to which it is applied. When properly used in this way, it is sufficient to prevent the feeling of pain during small operations, and is frequently resorted to. It is also an **anaphrodisiac** when locally applied, or a shower of cold water is sent along the spine. It is **antispasmodic**, as when a child with convulsions or spasm of the glottis is relieved by pouring several pitcherfuls of cold water over the head and neck. The cold douche is a powerful respiratory excitant in cases of narcotic poisoning and in asphyxiated infants. In chorea, cold applied to the spine, either by the douche or by ether-spray, has produced satisfactory results, and a similar application may be made in hysteria. In hysterical catalepsy, hysteria major, convulsions, etc., the sudden pouring of a bucketful of cold water upon the face and mouth, from an elevation of three or four feet, frequently has a marvelous effect. A similar douche of cold water from a pitcher is useful when poured upon the abdomen in cases of inertia of the uterus, either before or after childbirth. In suppression of urine, a cold douche to the dorsal region of the spine often causes free secretion of urine. Contraction of the bladder may be induced in the same way. The application of cold by baths has already been considered, but as an illustration of its usefulness the following case may be quoted: Maurice Letulle[1] describes the case of a man with a severe attack of delirium tremens. The temperature was 104.5° F., and the face and extremities were cyanosed. Seven hours after the beginning of the attack he was given a cold bath of 64.4° F. He remained in the bath for thirty minutes, and at the end of that time suddenly passed into a state of collapse, with the pulse remaining at the same rate as when he entered the bath, 108. The temperature had fallen to 92.6° ten minutes after the bath had been given. From this extremely low point the temperature gradually improved until twelve hours after the bath had been given, when it was normal. The patient did not have a return of the delirium. Letulle regards this as a distinct improvement upon the use of opium, chloral, or digitalis. The bath in the case described was administered for too long a time, but he thinks it is justified in these very grave cases, and in the case in question it was followed by a lowering of the temperature and a disappearance of the delirium.

The anodyne effects of cold are utilized in the treatment of inflammation, contusions, etc. Sprains, as a rule, are best treated with a local bath of very hot water, followed by compression. Should pain follow, the dressings may be wet with ice-water. This is also useful if there is pain after fracture. In acute inflammation of joints, the ice-bag is of great service in checking inflammation. Compresses of flannel wet with ice-water are useful in tonsillitis, pharyngitis, and laryngitis. Amenorrhœa, or menstrual suppression, has been overcome at the end of three days by the application of an ice-bag to the lower dorsal and lumbar regions of the spine. On the contrary, uterine hæmorrhage can be promptly checked by a hot-water bag (115° to 120° F.) to the spine. W. Frank Glenn[1] points out that the application of heat to the spinal cord reduces the amount of blood in the lungs and other vascular organs, and relaxes the capillary system, and is therefore valuable in pneumonia.

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[1] *Presse Médicale*, July 8, 1899.
[2] *Lancet-Clinic*, Oct. 14, 1905.

Dry cold is used by means of an ice-bag or bladder filled with broken ice. The skin should be protected by means of one or two layers of flannel, or local freezing (frost-bite) may be produced. This method is used in pneumonia, meningitis, and congestive headache. The ice-bag should be partly suspended by a cord so as to take its weight from the head. This also has some effect upon the general temperature. The method has also been utilized in cases of fracture, in vertebral caries, in orchitis, or epididymitis, and in numerous other conditions where it has proved exceedingly valuable. Dr. John A. Miller has used ice with excellent results in phlegmasia alba dolens. A large towel was dipped in ice-water, wrung out and wrapped around the affected limb, after which a heavy flannel roller bandage was applied from the toe to the groin. Over the most painful parts, were placed rubber bags filled with ice and kept in position by an additional bandage. Pain was markedly relieved by this practice and the temperature was speedily reduced. From the application of ice over the cardiac region M. Jullien has derived great benefit in grave ataxic forms of typhoid fever, in which death seemed imminent. The result was reduced frequency and increased strength of the pulse, together with reduction of temperature and disappearance of the cerebral symptoms. The application should be watched carefully, as to its results, but there appears to be no danger in prolonging it, while the general condition remains dangerous. In pericarditis, whether dependent or not upon rheumatism, Dr. D. B. Lees, of London, made use of a similar method with satisfactory results. He was led to its use in this disease by his experience with it in the treatment of pneumonia. Dr. Lees concludes that the ice-bag when used with caution is a safe application in pericarditis, that it is usually liked by the patient, tends to check the violence of the local inflammation and to restrict effusion. The application even seemed to assist in the absorption of fluid, which was already present[1]; Dr. Angus McGillivray, of Dundee, states that the treatment of ocular wounds by means of the continuous application of iced compresses has given him great satisfaction. Letulle and Ribard described their method of the local application of extreme cold ("krymotherapy") to overcome the anorexia of phthisis. Their plan is to apply during about half an hour every morning, a bag, containing about 2 kilogrammes of carbonic-acid gas, to the epigastric and hepatic regions. The skin is protected by a thick layer of cotton-wool, and maintains a temperature of about 25° C. A second application precedes the evening meal. Letulle and Ribard prefer the above-mentioned method, and think that some organs, such as the liver, are cooled more than others by the cold. The organism has to resist the cooling process, and the result is an increase of nutritive changes, a burning up of old materials, an absorption of new materials, and an increase of appetite corresponding to the increased digestive vigor.

By the employment of **liquid air** an intense degree of cold is rapidly produced. This has been recently introduced into medicine as a method of local refrigeration. Campbell White has employed this agent in varicose ulcers, chancroids, and some specific ulcers. He believes that nothing will so quickly, thoroughly, and painlessly stimulate granulation as does the proper application of liquid air. He has also used liquid air in sciatica,

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[1] *British Medical Journal*, Feb. 18, 1893, p. 344.

herpes, and intercostal and facial neuralgia, obtaining permanent relief by applying liquid air to the spinal end of the affected nerve.

Care should be taken in applying cold to weak or elderly people, and in those with a marked valvular lesion of the heart; for in all these cases reaction, if it occur, will be slow, and it might lead to catarrhal attacks. The cold douche must not be used in fever if there be extreme weakness and feeble pulse, with delirium and cool, clammy skin.

Evaporating lotions, used in treatment of contusions and inflammations around joints, are merely a method of obtaining refrigeration or cold; but as they commonly involve the use of various medicaments other than cold, they need not be considered here.

Small pieces of ice, allowed to melt in the mouth, allay irritation in cases of sore throat and also nausea, and thirst in cases of fever.

LIGHT AND DARKNESS.

Light and darkness are relative terms. Just as cold is merely the absence of heat, so darkness consists in the deprivation of light. Like heat, also, it is a form of energy, and is regarded essentially as a mode of molecular motion. Modern physics recognizes, in fact, a very intimate relation between light and heat. In the rays of the sun and those emanating from an ordinary incandescent or luminous object, such as a lamp or fire, light and heat are always associated. The rays of light are less diffusive than heat-rays, and the latter may be separated by passing through a saturated solution of alum, which absorbs the heat-rays, but permits the light to pass. In what is termed phosphorescence in insects and luminous bacteria, the heat-rays are deficient. In addition to light and heat, the rays of the sun contain energy, in a form of peculiar activity. These obscure rays, which, in the solar spectrum, are found in and just beyond the violet, are known as the **actinic** rays. As it has been found that the actinic rays produce very marked chemical and photographic effects, it is very probable that part of the physiological and therapeutical effect of the sun's rays on the human organism may be ascribed to this source. The effect of sunlight upon the nervous system is sometimes excessive and injurious. In the West Indies, for instance, sun-stroke is much more to be dreaded than in more temperate countries, as it frequently sets up myelitis, neuritis, or some degenerative process in the body, which results in paralysis, insanity, or chronic invalidism. Even in our Northern cities meningitis is often caused by the sun's rays. From this we conclude that sun-stroke, or insolation, is something more serious than thermic fever, or a temporary overheating of the blood, the effects of which, by the way, are more marked in the lower animals than in man.

The Finsen light is obtained from a large arc lamp of 20,000 candle-power, or twenty times as powerful as the ordinary arc lamp for illuminating purposes. A specially-prepared large carbon is used for the upper carbon, and a smaller one is used in the bottom holder. When properly adjusted and with the necessary ampèrage, a maximum number of violet and ultra-violet rays are produced. A much larger proportion of chemical rays is found in the arc-light than in the sunlight. During the use of the lamp the

rays of light are so intense, that it is necessary for all the attendants and patients to wear dense smoked glasses. An aluminum hood about two feet wide surrounds the lamp; it is fringed upon its lower border with deep crimson-colored paper, in order to protect the patients from undue exposure. The concentrated rays are carried from the arc to the patients through four telescopic converging tubes, suspended at an angle of 45°. These tubes contain a series of rock-crystal lenses, so arranged that spaces for running water are left between them. By means of this water-screen and the rock-crystal lenses, all rays except the violet rays are shut off or intercepted. If it were not for the stream of cold water kept constantly running through the reservoirs, the intense heat of the arc would crack the lenses and burn the patient. A similar apparatus, called a compressor, is also interposed. This is provided with two large rock-crystal lenses, with a water reservoir between them, through which water is kept running. This part of the apparatus is used to compress the affected area and make it bloodless during the treatment, thus favoring local action and deeper penetration. Dr. H. John Stewart, of Chicago,[1] who furnished the preceding description, after a personal inspection of the Finsen Medical Light Institute, at Copenhagen, states that in six years this has grown from a small shed, where they could treat but one patient at a time, to a magnificent institution, where they were treating 300 people daily, in 1904; similar light-healing hospitals have been started in the principal large cities of the world. It is probable that such institutes will be established in every large city in this country within a short time. The treatments are given to patients who are lying on couches. The affected area to be treated is placed about ten inches from the distal end of the converging tubes, and the tissues are flattened by the compressor. The treatments, or seances, take about one hour daily in lupus and rodent ulcers; in other cases, from ten to twenty minutes, depending upon the form of disease. It is claimed by Finsen that 97 per cent. of lupus vulgaris patients can be cured, even when the whole face is involved. The light treatment gives no pain. Immediately after, an erythematous spot, or a blister, appears where the light has been directed. In five or six days the scab falls off, and the ulcer is seen to be healed. There is no scar, but a redness remains for a variable period, ultimately leaving the skin soft, white, and uncontracted; except where there has been loss of tissue from the disease before treatment.

Physiological Effects of Light.—The tissues of the body are nearly opaque; but, with a high degree of illumination, such as may be obtained from the electric arc light, there is found a considerable amount of translucency. We may also introduce electric lamps into the mouth, the pharynx, or the stomach in order to examine the extent and amount of translucency of the surrounding structures. It has recently been shown that the rays of the sun are capable of passing directly through the body, to a limited extent. Under ordinary circumstances, it is probable that sunlight, to some degree, actually penetrates the skin and enters the soft tissues, stimulating and vivifying the cells by its warmth and actinic influence. That it does exert some very important effect upon nutrition is demonstrated by the fact that persons who pursue occupations that keep them constantly in the shade, and away from the sun, acquire a peculiar pallor, and become anæmic.

[1] *The Southern Practitioner*, Jan., 1904.

Moreover, not only are human beings dependent upon light for health, but, as a rule, animals depend upon it for their existence. The Mammoth Cave of Kentucky has very few species of the higher orders of animal life, and these show evidences of defective development and imperfections of structure. It is a well-known fact that plants need light, in order that the cells may properly elaborate chlorophyl. Since the color of chlorophyl is due to a soluble salt of iron analogous to hæmatin, which is the chalybeate compound to which the red blood-cell owes its color, the paleness of plants grown in darkness is strictly analogous to the paleness of mill-operatives and weavers, whose occupations keep them from exposure to sunlight. Light is not only necessary to physical health, but also for the moral nature. Darkness is depressing to the spirits and unfavorable to intellectual development. The punishment of the dark cell has been abolished almost entirely from penal and reformatory institutions, on account of its unfavorable influences upon the mind and the tendency to cause insanity which has been observed where it has been practiced. There can be no question that the superior intelligence and quickness of comprehension of the human race, among the highly-favored nations, is due, in great part, to their success in providing artificial illumination for all classes of society,—literally turning night into day.

It has been experimentally demonstrated that sunlight inhibits or retards the growth of pathogenic microbes. Tubercle bacilli will not grow upon culture-media in direct sunlight, and even ordinary daylight is fatal to them within a period varying from a few minutes to several days. Diffused daylight exerts an adverse influence upon the Klebs-Loeffler bacillus, or organism of diphtheria. Janowski observed that the growth of the typhoid bacillus was checked by the diffuse light of a cold winter's day, and that direct sunlight destroyed the microbe in the course of several hours. As a result of experiments, he concluded that these effects depended upon the chemical rays. Strong sunlight is injurious or fatal to anthrax spores. The destructive effect of light upon bacteria has been pointed out by Dawnes and Blunt,[1] Geisler,[2] and many others. In 1894, Dieudonné proved that direct sunlight in the summer, would kill spores in two hours; diffused daylight, in about five hours; electric arc (900 candle-power), in eight hours; and incandescent light, in eleven hours.

This bactericidal effect was attributed by Finsen, of Copenhagen, to the violet rays, or ultra-violet rays, of the spectrum. These rays, he obtained from a specially constructed arc light, by which all the other rays are removed from the light. Quartz crystal lenses are used in condensing the light, as ordinary glass obstructs the violet rays. (See page 1120). The electric light likewise has a similar action, which, according to Professor Marshall Ward, is direct upon the spores, and not due to a chemical alteration in the culture-medium as had been supposed by some writers.

J. Mount Bleyer, of New York,[3] called attention to the favorable influence of the sun's rays upon metabolism. The exposure of the human body (nude), to sunlight or the electric arc light, especially increases the assimi-

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[1] Proceedings of the Royal Society of London, 1877.
[2] Centralblatt für Bakteriologie, 1892, vol. xi, p. 161.
[3] *Medical Record*, Jan. 31, 1903.

lation of iron and increase of hæmoglobin, for instance, when Blaud's pill, the ammonio-citrate, carbonate, or other chalybeate preparations are taken.

Ferdinando Battistini (*Rivista Critica di Clinica Medica*) uses the electric-light bath according to Kellogg's method, with forty lamps rendered incandescent by a current of 100 to 110 volts. He begins with a temperature of 30° C., progressively increasing up to 50°, and rarely to 60° C. The duration of the bath is from fifteen to twenty minutes. In all cases copious sweating occurs promptly. The pulse and the respiration are increased in frequency. The effect on the blood-pressure varies. In persons whose circulation was normal, or in whom arteriosclerosis was in the initial stage, the pressure was very slightly increased, or else not affected. In a second group of patients, apparently normal or else suffering with grave arteriosclerosis, the pressure was as high as 35-60-70 mn. of mercury. Arrhythmia was noticed in some cases. The cardiac area was, as a rule, not affected. The sphygmographic curve was usually fuller during the bath, and occasionally there were signs of dicrotism. The author concludes that this method of treatment should be used very cautiously on patients with a weak heart, or on those suffering with arteriosclerosis.

Therapeutical Deductions.—The chemical rays of light are especially useful in medicine on account of their power (1) of destroying bacteria, (2) of exciting inflammation of the skin, and (3) of penetrating the skin. In the method pursued at the institute of Dr. Finsen, at Copenhagen, direct rays of sunlight or the light of electric arc lamps of 50 to 80 ampères is employed. The light is concentrated by means of a convex lens. In order to avoid burning the skin, the heat-rays are cut off by a screen, consisting of an ammoniacal solution of copper sulphate, confined in a cell on one side of the lens, made by deepening the frame of the lens and attaching a plain piece of glass. The lens is hung upon an upright stand, so that it may be raised or lowered, and turned on a vertical and horizontal axis. In the case of the electric light, a system of lenses inclosed in a tube, resembling a telescope, is used. An area of skin of about one and one-half centimetres ($^3/_5$ inch) in diameter is treated for one hour every day. Redness, swelling, and perhaps bullæ may appear, but necrosis has never been observed. The most striking results have been attained in cases of lupus vulgaris and erythematous lupus. Dr. George G. Hopkins, of Brooklyn, N. Y., gives photographic illustrations to demonstrate the effects of treatment. Dr. Finsen applies the same treatment to carcinoma, in some cases of which very encouraging results have been obtained.

Kozlovski, in *Vrach*, has published an account of his treatment of rheumatism and neuralgia by means of exposure to the electric arc. Kozlovski fitted up a consulting-room with a suitable plant for producing the electric arc. With these he obtains an electromotive force of 50 to 60 volts and a current of from 250 to 300 ampères. The patient is protected by blue spectacles and also by a screen of cardboard in which an aperture is cut to allow the light to fall on the affected region of the body. To this it is exposed for from three-fourths of a minute to two minutes. In the course of three months Kozlovski treated 38 patients, varying in age from thirteen to seventy years, by the electric light. There were 8 cases of sciatica, all of which recovered; 4 of neuritis; 3 of lumbago, all of which recovered; 3 of occipital neuralgia, of which 2 recovered; and 2 of trigeminal neuralgia, 1 of which was greatly benefited. In most cases three or four sittings pro-

duced an amelioration of the pain. They were continued at intervals of three or four days, but the total number of sittings never exceeded a dozen.

As the absence of light favors anæmia and consequent lowering of vital tone from defective nutrition of the great centres, it is obvious that where this cause is operative it should be recognized and corrected in the treatment of **chlorosis, scrofula, scorbutus, consumption, debility, dyspepsia, neuralgia,** and a host of other disorders of impaired nutrition. **Neurasthenia,** when unattended by latent organic affection, should be treated by sun-baths, gentle massage, life in the open air, and easily-assimilated nutritious food. In weakly children this course is followed by very satisfactory results, and a tendency to **marasmus, scrofula,** and **anæmia** may be thus overcome. **Anhæmatosis** is corrected by the actinic effects of the sun's rays, and the early stage of progressive anæmia may be amenable to this form of treatment in conjunction with proper diet and appropriate remedies.

In the treatment of the sick, a light, cheerful room is of great assistance to recovery. Especially should an invalid have a room into which the sunlight may enter. The eruptions of the **exanthemata** are made easier by light and heat, and the course of the disease favored. Where it is not desired to favor eruption, the part of the body may be covered with a piece of muslin or an ointment which is impervious to light. Thus, in **small-pox,** pitting of the face may be prevented by having the patient wear a mask of linen, or by covering the surface with mercurial ointment. In some cases of **acute mania,** or **delirium,** it is advisable to have the sick-room partially darkened, and in **hysterical neurosis** it is sometimes observed that the patients are extremely sensitive to sunlight. On the contrary, persons suffering with **melancholia** and **hypochondriasis** are benefited by light and attractive surroundings. The low spirits of **dyspeptics** are dissipated by a daily walk in the open air, while regular, systematic out-door exercise is of great benefit to the patient in strengthening the digestive functions and enabling him to "outlive his dyspepsia." Dr. J. W. Kime, of Fort Dodge, Iowa, has devised a combination of mirrors, which are employed to concentrate the sun's rays, which, after passing through a screen of blue glass, are directed upon the patient's body, at the distance of about eight feet, so that the rays will be focused upon the part to be treated.[1] He has used it in chronic joint diseases, in parasitic affections of the skin (such as lupus), and suggests its use in pulmonary tuberculosis. O. V. Thayer[2] has used the sun's rays through a convex lens, as an actual cautery to diseased tissues. He declares that within the period of two minutes the infecting chancroid, and the Hunterian chancre, are deprived of their contagion and become changed to a simple ulcer, which readily heals. Hæmorrhoids, when external to the sphincter ani, are destroyed and slough away, without unpleasant symptoms. Indolent ulcers are stimulated to new reparative action by the sun's rays. Granular surfaces which bleed easily are changed, and hæmorrhages from small arteries or veins at once checked. Parasitic diseases of the skin are cured. Small malignant growths can be completely destroyed. Lupus is also successfully treated.

The Roentgen Rays in Medicine.—Of all the forms of radiant energy with which we are acquainted, the peculiar manifestation discovered by

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[1] *Journal of the American Medical Association,* May 12, 1900.

[2] *Pacific Medical Journal,* Oct., 1905.

Professor Roentgen, of Wurzburg, in 1895, has proved to be of the greatest value from a therapeutic standpoint. When the frequently-repeated impulses of the static, or indirect current, are made to pass through the partial vacuum of a Crookes tube, there proceeds from the cathode a stream of radiant energy, part of which passes through the glass bulb and is projected in a straight line. This includes the so-called x-rays, but these are associated with other rays, according to Freund, the radiation consisting of (1) heat, (2) ozone, (3) cathode rays, (4) ultra-violet rays, (5) rays of material particles from the anode, (6) Roentgen rays, (7) sparks and electric discharges from the surface of the tube, (8) electric, or electro-dynamic, waves, and (9) rays of an unknown character. The only constituents which need be considered are the x-rays proper, the unknown rays, and the electric discharges from the surface of the tube. When the tube is held too near the surface, it is possible that the shower of material particles may be also effective, especially in causing destruction of vitality. The ultra-violet rays are not intense, and probably do not escape from the tube in any great number, as they are checked by glass. The source of x-rays is an exhausted glass bulb placed in the path of an electrical discharge, or rapidly-consecutive discharges, obtained by means of a Ruhmkorff coil, or an influence electrical machine. The x-rays have more decided effects than the Lenard rays, in photographing the invisible. X-rays pass directly through opaque substances, but their intensity is diminished by some more than by others. Metals, the osseous frame-work of the body, and solid organs (or tumors) throw more of a shadow than the softer parts. Photographs thus obtained are called skiagraphs, and an instrument, like a stereoscope, for examining the parts, is called a skiascope.

The apparatus for x-ray examination is now a part of the equipment of every general hospital. It is of the greatest service in the diagnosis of fractures and in examination during the progress of the case.

Apparatus.—Various forms of tubes have been tried, some of which possess decided advantages. The unipolar tube, for instance, of Samuel Stern[1] has a special application for deep applications in the cavities of the body, as in laryngeal or vaginal cancer.

Reduction of the Vacuum in a Crookes Tube.—W. T. Stewart[2] proposes what is apparently a simple method of lowering the vacuum of tubes that have become too hard. Some time ago it was stated by English observers that a tube could be softened by baking it for several hours. This has led Stewart to devise an oven which will give a uniform temperature and not subject the tube to a higher temperature in one place than another. The outer shell of the oven is composed of sheet iron lined with asbestos. Within this is an inner shell of corrugated iron with openings, by which the heat is distributed equally over all parts of the chamber. An alcohol burner furnishes the necessary heat. It requires from five to fifteen minutes to satisfactorily reduce a tube.

Caldwell[3] describes an x-ray tube for treating internal parts, as the cervix uteri, rectum, larynx, etc. The target is placed not within the spherical part as usual, but at the end of a tubular projection from it. In using the x-ray apparatus, leaden shields and specula are used to protect sur-

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[1] *Archives of the Roentgen Ray*, Sept., 1905.
[2] *American X-ray Journal*, Feb., 1903.
[3] *New York Medical Journal*, May 12, 1902.

rounding tissues, although uterine cancer is treated by rays from a high vacuum tube, directly through the perineum, or through the abdominal wall. The high tension tubes are less likely to produce dermatitis than the low tension. By repeated exposures the tube tends to become harder or of higher tension. With regard to these Clarence E. Skinner, of New Haven, says:[1] "A practical point involving some difficulty is the rapidity with which the vacuum of high tubes will be worked up beyond a manageable limit by the long and frequent seances demanded in therapeutical applications. Chemical regulation of the vacuum is a partial success, and ordinarily will nearly double the life of the tube. The method of overcoming the difficulty that has given me the most satisfaction, however, has been to have the tubes made without chemical and exhausted to medium vacuum. Then when the tube refuses to glow from use, have it baked, at a temperature of 350° F., for from thirty minutes to ten hours, according to the idiosyncrasy of the individual tube. If the tube is baked too long the vacuum will get too low, but that can always be overcome by running the tube hard for a few minutes upon a static machine with open spark-gaps."

For the protection of the operator, various devices have been suggested. One of the best of these is the screen of Talley and Newcomet,[2] which consists of three sections, each 24 inches wide and 6 feet high, which are joined by hinges. Each section is made to hook rigidly at right angles with its fellow, thus making three sides of a box six feet high. By leaving one side open, the patient can easily be placed in position, or removed. Two sides of this screen are lined with sheet lead. In one is a movable window for the fluoroscope, which should be large enough to give a shadow of the whole chest without being moved. The third side is not covered with metal, but simply with black paper to enclose the x-ray tube, and thereby lessen the light in the room, and at the same time to act as a frame for measurements and plumb-lines used for centering the x-ray tube. The side directly opposite has the frame for the fluoroscope adjustable for different positions. Over the fluoroscope is placed a piece of plate-glass, which is transparent to light rays, but blocks the x-rays to a great extent. At the same time it serves another purpose, in protecting the screen from being scratched by the point of the pantograph, which is used for recording the conditions as they are shown to exist. The pantograph is firmly attached to the same side of the screen on a soft piece of wood, so that paper can be easily placed under the pencil and held by a few thumb tacks. The tracing on the glass over the fluoroscope will be thus easily recorded, about $^1/_6$ its natural size, which is very convenient for clinical records. It is best to have this instrument attached to the side, not to the protecting connecting side, as it will lessen the danger of the operator's coming in the range of the active ray. It is advised, in order to minimize the danger to the patient, to adopt the cardinal rule, not to expose the body to the ray longer than is consistent with thorough examination, and not to reëxamine at too close range. It is also important to use only enough energy to penetrate the body, which is much less in a dark room than in one only semi-dark, and at the same time the eye must be accustomed to the darkness. The x-ray tube must be kept at least a foot away from the body; and 18 inches is better. Besides lessening the danger of burn, there is also less distortion of the shadows on the screen.

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[1] *The Medical Standard*, March, 1903.

[2] *Journal of the American Medical Association*, Feb. 24, 1906; page 553.

Unfortunately in heavy subjects, it will be found that 18 inches distance is too far away for a good penetration.

Much experience in skiagraphy and in handling tubes should be had before attempting therapeutic applications. This work is much more satisfactory than it used to be. M. H. Kassabian[1] has taken instantaneous skiagraphs in one second, the time of exposure depending largely upon the size and character of the apparatus employed, the degree of vacuum of the tube, and the thickness of the part to be skiagraphed. The time employed by him in skiagraphing the hand is one second; wrist, two seconds; forearm, three seconds; elbow, three to five seconds; shoulder, ten to fifteen seconds; knee, ten to fifteen seconds; hip, forty to sixty seconds; face, ten to fifteen seconds; cranium, forty to sixty seconds; thorax, twenty to thirty seconds; abdomen, fifty to ninety seconds. These figures are a mean of those obtained in individuals weighing between 125 and 145 pounds. For an increase of weight of 15 pounds, one to two seconds must be added to the estimate. The time with the static machine is from one-fifth to one-third greater.

Dr. Graedel, of Nauheim, has obtained very satisfactory results recently from exposures of one-fifth to one-half a second. It requires a high voltage current from the main of 200-250 volts. A very large primary current is used, sometimes as much as 90 ampères, through a special triple anode electrolytic interrupter. (Lancet, June 6, 1908.)

A. D. Rockwell states[2] that, as regards the equipment for x-ray therapeutics, it varies but little from that of x-ray diagnosis. The same exciting apparatus, whether static machine or induction coil, is equally efficient for both uses, but there is something to be said in the way of differentiation of tubes. When a tube of low resistance is used to skiagraph a hand, for example, the shadows of the bones are quite distinct, indicating that the rays have been absorbed. With a tube of high resistance, on the contrary, everything is lighter, the shadows are less sharp, showing that most of the rays have passed through. Tubes of low resistance (or low vacuum), therefore, have not much penetrating power, and are recommended for the treatment of superficial diseases, since the surface absorbs so much of the light. Tubes of high resistance (or high vacuum) have greater penetrating power, and are to be preferred for deep-seated pathological conditions. As regards the distance that the tube should be placed from the patient, this will vary according to the apparatus used. Ordinarily, the limits are from 4 to 12 inches, or about 8 inches on the average, depending also upon the disease, the desired length of exposure, intensity, etc. Exposures may be made once or twice a week; rarely once a day. The time of exposure is from five to twenty minutes. As some patients appear to be very susceptible to the effects of the rays, Beck recommends that the preliminary exposures shall not be longer than five minutes, and after a week, ten minutes. If, after a third exposure (two weeks after the first), no reaction follows, the patient apparently possesses no idiosyncrasy. Then the treatment may be given every two or three days, and at last daily, unless intense reaction occurs. During the tentative exposures the distance of the tube should be at least four inches: later this may be reduced to one inch.

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[1] *American X-ray Journal*, Feb., 1903.
[2] *The Medical Critic*, Feb., 1903.

Used with such precautions, and with a tube suitable for the kind of work, the x-rays can be applied with safety to the patient. If the limits of caution are exceeded, tanning of the skin, erythema, and sloughing of soft parts down to the bone may be induced. Such accidents have led to suits for malpractice. Too frequent exposure, in the attempt to hurry the treatment, may lead to local and general sepsis.

Effects of the X-rays.—While bactericidal effects can be demonstrated, yet, as used in ordinary therapeutic applications, it is probable that the bactericidal influence is negligible, in the opinion of Samuel Stern.[1] The effect of the x-rays upon cellular elements of tissues may be comprehensively stated as stimulating, at first and in small doses; but destructive if used too long, too frequently, or in too large doses. The fact that diseased tissue has feebler vitality than healthy tissue is at the foundation of the therapeutic use of this agent, since it will be destroyed before the healthy tissue becomes affected. E. Dalous and J. Lassere Toulouse (*Annales de Dermatologie,* Paris), write: "The microscope reveals that there are certain special lesions due to the action of the Roentgen rays on the epithelium, an actual 'radio-epithelitis,' as Dalous styles it. Similar modifications occur in the tissue of a neoplasm, and as they develop they induce a macrophagic connective-tissue reaction. All the cells of the neoplasm do not feel the effect of the rays to the same degree, some being more sensitive than others. In the sound epithelium the basilar layer, or *stratum germinativum,* and the cells of the mucus layer, immediately above, are affected most, and the corresponding cells in an epithelioma. On the other hand, the cells of the prickle layer and of the horny layer are too firmly interlocked and too large to be effectually attacked by phagocytosis. The latter process, besides, seems to be secondary in importance. The histologic findings described explain why epitheliomata of the type of the cancroid and the squamous epithelioma are less favorably influenced by radio-therapy than epitheliomata of the basocellular type, columnar epithelioma, and rodent ulcer. The Roentgen rays are decidedly elective in their action. The most sensitive cells in the neoplasm are those which are derived from cells which normally are most sensitive to the action of the rays. In cutaneous epitheliomata, therefore, the squamous and the columnar types, the former are resistant to the x-rays and the latter succumb to them, corresponding to the elective action of the x-rays on the cells of the sound epidermis."

The first effect upon the tissues is a stimulation of the vaso-constrictor nerves, thereby interfering with the blood supply of the part exposed. This condition is followed soon by gradual paralysis of these nerves, if the stimulation is continued, and hyperæmia is produced. This may develop local dermatitis; or there may be local gangrene of very slow progress, but generally deep and extending to the bone. In some cases, where the applications have been too frequent or prolonged, molecular disintegration takes place, which leads to septic infection and death from exhaustion. It has happened to persons frequently exposed to x-rays, as operators or assistants, that injurious results have ensued. Loss of hair, chronic inflammation of the skin of the backs of the hands, fingers, and arms, and even malignant degeneration and epithelioma have been observed. One of the effects upon

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[1] *New York Medical Journal,* March 10, 1906.

males has been sterility or impotence. With the use of what are called "hard tubes," in which there is a good vacuum, and the protective appliances now obtainable, and with proper care, the evil effects of the x-rays can be entirely avoided.

Roentgen Rays in Diagnosis.—In surgery the diagnosis of fractures in bones, dislocations, sprains, morbid growths, calculi in the urinary passages, or in the bile ducts, location of foreign bodies, detection of anomalies of development, and many other conditions are now made by the aid of x-rays as a routine procedure, in all hospitals, and is extending in private practice. In medical cases, various morbid conditions of the lung and pleura can be plainly demonstrated; effusions and new growths located; also foreign bodies. Hypertrophy of the heart, pericardial effusion, aortic aneurism, enlarged bronchial glands, are also recognizable. Floating kidney, gastroptosis, hepatic dislocation, ectopic gestation, appendicitis, are also made evident.

The screen of Talley and Newcomet facilitates skiagraphic study of various lesions, especially in those of the heart and lungs. Here the fluoroscope gives the shadow of the living pulsating organ, and the size of the heart can be ascertained. Pneumonic consolidation, or abscess cavities, are plainly discovered.

Roentgen Rays in the Diagnosis of Pulmonary Diseases.—J. F. H. Dally has an exhaustive article in the *Lancet* of June 27, 1903, on the value of the Roentgen rays in the diagnosis of thoracic conditions. This new method of investigating the chest should not be separated from the ordinary methods of physical research, although an accurate diagnosis may sometimes be based on the x-rays alone.

The writer's observations were made with an induction coil, capable of giving a 14-inch spark at high pressure, between the terminals of the secondary coil. Mueller's tubes of moderate hardness were used. Both radioscopy and radiography are indispensable in the investigation of intrathoracic conditions. The choice of one or the other depends upon circumstances. Radioscopy should be used at first, combined with auscultation and percussion. This may be followed by the taking of radiographs from different points, the latter supplementing the fluoroscopic investigation.

The text-books on physiology state that the diaphragm is flattened in expiration. Examination with the radioscope shows that the curve of the diaphragm is not altered, but that it descends and ascends without alteration of the curvature, and that in quiet breathing the excursion amounts to about half an inch; in forced respiration the depression amounts to 2⅞ inches on the left to 2⅝ inches on the right side. Repeated observations show that loss of motility of the diaphragm is the earliest indication of tuberculosis. Before any shadow due to the tuberculous process of the lung is visible, the action of the diaphragm is lessened on the affected side. The typical shadow cast by early tuberculous deposit is mottled or stippled. This appearance is characteristic and is simulated only by new growth. Other shadows for which the tuberculous shadow may be mistaken are those due to adhesions or to such normal appearances as the mammary shadow or the pleural and pericardial lines. All of these may be distinguished by their greater homogeneity and regularity. Consolidation shows a shadow of moderate density, and this is increased if the lung be congested. The loss of permeability due to caseation throws a still darker shadow. Appearances

presented by cavities vary according to their size, position, and whether empty or not. Cavities only half an inch in diameter have been clearly seen during life, and their existence verified post-mortem. A cavity at the apex, or on the side nearest the focus tube and close to the surface of the lung, appears, if empty, as an area of unusual transradiancy. If full of pus or retained secretion, if embedded in the centre of the lung, or in a mass of consolidation, it may not appear, or it may be found lighter or darker than the surrounding tissue. In many cases cavities appear, upon examination, to be smaller than the auscultation sounds indicate.

In pleurisy, in the early dry stage, there is no shadow. If there is effusion the appearances vary according to the nature and amount of the fluid. A purulent effusion yields a darker shadow than a serofibrinous effusion, the shadow in each case being homogeneous.

Emphysema, bronchitis, and asthma are so frequently associated that they can be grouped under one head. Emphysema is indicated by brightness of the lungs as a whole, or if only parts of the lungs be affected, by brightness of those parts. This brightness is intermediate between the normal clearness of the lungs and the exceptional brilliancy seen in pneumothorax. Bronchitis has no peculiar appearances. The shadows in cases of asthma are similar to those in emphysema.

In pneumonia due to engorgement and exudation, a light shadow is cast. Consolidation gives a dense shadow, with ill-defined edges. In doubtful cases where pneumonia is suspected, but there are no physical signs, the Roentgen rays are often of service. By their aid a central patch of pneumonia may be revealed. The excursion of the diaphragm is limited in pneumonia, as it is in tuberculosis and pleurisy. Whenever this limitation is noted, these conditions should be considered. Restoration of diaphragmatic function is found by experience to be a more accurate test of recovery than alteration of the physical signs, or diminution in the opacity of the lung.

The location of foreign bodies by this method has gained universal application. In the case of foreign bodies in the eye or brain, many ingenious methods have been devised for exactly locating the object, thus greatly facilitating its removal by surgical operation, and unnecessary probing is in this way avoided. In gunshot wounds of different portions of the body the missile is readily recognized. In all forms of calculi existing in the bladder or elsewhere this method affords the most satisfactory means of studying their number and location. In the diagnosis of calculous nephritis it offers the only possible means of positive diagnosis, except an exploratory operation. It also shows the absence or presence of calculi in the other kidney. Consolidated areas of the lung in pulmonary phthisis may be recognized by their relative opacity, and skiagraphs may be obtained from time to time. Mediastinal tumors have been differentiated from aneurisms, tumors of the liver have been recognized, and the size and movements of the heart demonstrated. Dr. Charles L. Leonard has suggested that the outlines of the kidney, shown in the skiagraphic examinations for renal calculi, make it highly probable that the position and size of renal tumors, or the malformation or entire absence of a kidney, will be readily detected. If we desire to follow the outline of the spleen more fully, we can, by filling the stomach and large intestine with air, contrast the dark area of the spleen with the light area occupied by the gas,

through which the rays readily pass. When it is desired to examine the large intestine, air may be pumped into it, and its outline, such as the sigmoid flexure, and the descending colon, be easily followed. By distending the stomach, and in some cases the large intestine, we can detect some pathological conditions in or about the pancreas. When fluid is present, the examination should be made with the patient lying on his back and the tube on a level with the fluid, the rays from it passing through the abdomen horizontally. Patients with suspected "phantom tumor" should always be examined by the x-rays. The administration of subnitrate of bismuth in half-ounce doses causes the digestive tract to become opaque to the x-rays. By examining in this way, at various periods, the outline of the stomach and the progress of the bismuth along the intestine can be demonstrated.

Therapeutics.—In skin diseases, the x-rays have a very extended range of usefulness, especially in parasitic and chronic affections. Thus, non-parasitic sycosis, alopecia circumscripta, (tinea decalvans), pityriasis, tubercular lesions, lupus, sarcoma, and epithelioma have all been successfully treated. Mycosis fungoides has also yielded, but requires continued treatment to successfully overcome the tendency to relapse. In acne vulgaris (both pustular and indurated varieties), good results have been reported by numerous observers. Paget's disease of the nipple has been cured.

Stern advocates a combination of the high-frequency spark and x-ray applications, and declares them of extreme value in the cure of all forms of epithelioma. In other forms of malignant growths, they are useful in relieving pain and assisting in prolonging life, but should only be used in non-operative cases or in conjunction with surgical measures. In internal diseases, they are useful in leukæmia, Hodgkin's disease, various forms of chronic tubercular conditions, in subacute and chronic rheumatism, lumbago, sciatica, and other neuroses. He claims 100 per cent. of cures in sycosis non-parasitica, and almost as great percentage in eczema and in psoriasis. Although useful in acne vulgaris, it is not of much value in rosacea. It is highly valuable in favus, tricophytosis, keloid, lichen, mycosis fungoides, folliculitis decalvans, and hypertrichosis. The x-ray, or high-frequency spark, or the combination of both, is very valuable in the treatment of all forms of pruriginous affections due to any cause.

F. H. Williams, in two cases of herpes zoster, reported immediate relief from pain and burning sensation.

Chronic leg ulcer has been cured by radiotherapy, applications being made at intervals of 3 to 7 days. (W. L. Heeve.)

In **rhinoscleroma**, Gottignies (*Journal Medicale de Bruxelle,* June 18, 1903) reported in one case marked improvement under the treatment.

In **locomotor ataxia**, John W. Daniel, in two cases of very marked type, obtained remarkable improvement, both in ability to walk and in eyesight (*Medical Age,* June 10, 1903).

Actinomycosis was successfully treated by A. D. Bevan (*Medical Record,* May 30, 1903) by large doses of potassium iodide internally, and x-rays to the tumors.

In the treatment of **pseudoleukæmia**, or Hodgkin's disease, numerous observers report successs. Thus, J. T. Dunn (*International Journal of Surgery,* October, 1903) reports a case involving the glands of the neck,

which had been in progress for seven years, and the patient had lost fifty pounds in weight. After fifteen treatments there was decided improvement and a gain of sixteen pounds. A further series of treatments restored the patient to normal. F. H. Williams (*Medical News,* October 3, 1904) finds that in Hodgkin's disease the x-rays will prolong life, and in some cases will cure.

Scrofulous adenitis, especially of the neck, yields readily to x-rays. In myelogenous leukæmia, Oliver T. Williams (*Bio-chemical Journal,* April, 1906), after x-radiation, observed a marked increase in the number of leucocytes, with an increase of nitrogenous excretion and of uric acid. A rise in temperature also was observed (100.6°). He concludes that, in this disease, exposure to x-rays produces a disintegration of proteid material in the leucocytes, the products formed giving rise, in some cases at least, to grave constitutional disturbance. It is suggested that when x-ray therapy is used in this disease, the patient should be allowed a sufficient time between each exposure to excrete the toxic products which are formed. The daily estimate of the uric acid excreted affords an indication of the length of such intervals, and also gives an intimation of the safe dose of x-rays to be used.

Malignant Growths.—William Coley, of New York, found that x-rays have a very decided inhibitory action upon the various forms of sarcoma, in certain cases sufficient to cause the entire disappearance of inoperable tumors. Yet there is a strong tendency to local or general recurrence, and in no instance had sufficient time elapsed to warrant the statement that the patient had been cured. In deep-seated and inaccessible growths, especially spindle-cell, the results from the toxins will probably be better than those from the x-rays.[1]

A Supposed Sarcoma of the Kidney Cured by the X-ray.—C. H. Richmond, in the *New York Medical Journal* of May 30, 1903, describes the case of a married woman, forty years of age, who began losing flesh and strength and showed decided anæmia in the latter part of September, 1902. In the autumn of the same year a growth was found in the right side of the abdomen, which developed rapidly. It was believed to be a sarcoma of the kidney. The patient was given daily treatments of fifteen minutes each for nineteen consecutive days. The general condition rapidly improved and the tumor ceased to grow. At the end of nine weeks from the time treatment was begun, the growth had disappeared, so far as could be determined by bimanual examination. At the time of the report she was apparently as well as before the development of the severe symptoms.

Robert Reyburn, of Washington, D. C., states that if malignant growths occur at or near the surface of the body, this is the very best method of treatment. He believes that there are three methods in which the beneficent action of the x-rays and the continuous current may take place:—

First.—In the very earliest periods of the morbid growths, these agents cure by their stimulating and nutritive effect upon the vital processes.

Second.—In the second, or more developed, condition of the morbid growth, when we apply stronger currents of electricity, or give more vigorous x-ray treatment, we inhibit the growth of the tumor.

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[1] *New York Medical Journal,* Aug. 8, 1903.

Third.—When the growth of the tumor has more fully developed, we have to depend upon the necrotic or caustic effect upon the morbid growth of strong application of the x-rays, or powerful galvanic currents. Dr. Reyburn believes that "one reason why the x-rays often fail to cure these growths is that the application of them, or of the continuous current, is made over too small a surface of the body. It should always be remembered that the cancer cells are infiltrated into the tissues over a much larger area than the apparent surface of the tumor; a space three times the size of the tumor should always be treated by either the x-rays or the continued current."[1]

Unfavorable Action of X-rays.—When this method was at first introduced, it was used by crude methods and inexperienced operators. Cases were reported in which severe dermatitis had followed the prolonged exposure to x-rays and even epithelioma of the soft parts occurred, in some cases requiring amputation. Dr. Philip Mills Jones[2] declares that their character is that of necrosis, or local gangrene, in every way analogous to an ordinary burn, and not due to any action of electricity upon the part, nor to minute particles of metal projected into the tissues. These accidents are now very rare. Every tube in action evolves rays of low and high penetrating powers, in varying amounts, according to the degree of vacuum and other conditions. The rays of low penetrating power are given out when the vacuum in the tube is too low or when the tube is "soft," to use Professor Roentgen's recent designation. Dr. A. Clifford Mercer says that "a 'hard' tube or one with a high vacuum and requiring a high potential to work it, will give rays that pass freely through the flesh, and, not being absorbed by the skin, cannot, of course, do injury. . . . To avoid any risk of x-ray burns we must work the tube at such a high vacuum as to give rise almost entirely to rays of great penetrating power, or non-absorbability; or we interpose between the tube and skin surface a screen, which will cut off the more injurious rays by absorbing them."[3]

In the treatment of x-ray burns, moist alkaline dressings, or the cataplasma kaolini, will be found agreeable. In addition, Henry G. Piffard, of New York, recommends zinc chloride, and high-frequency currents or ultra-violet rays. The descending constant current might also be used to stimulate normal metabolism. Internal treatment with the glycero-phosphates and chalybeate preparations would be indicated.

Tilden, Brown, and Osgood (*American Journal of Surgery,* 1905, No. 9) state that men by their presence in the x-ray atmosphere incidental to radiograph for therapeutic use, or testing of tubes, may after a period of time be rendered sterile. The statement is based upon the discovery of ten x-ray workers who were the subject of total azoospermia, although none of them had suffered from any venereal disease or traumatism involving the genital tract, and none were conscious of functional derangement. Subsequent observations have increased the number of observed cases to eighteen, in all of whom either total azoospermia or oligonecrospermia was demonstrated. Indeed, all of those who had been working extensively in x-rays for more than three years, failed to show spermatozoa in their seminal

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[1] *New York Medical Journal,* March 17, 1906.
[2] *Pacific Record,* Oct. 15, 1898.
[3] *Philadelphia Medical Journal,* Jan. 6, 1900.

fluid. A few engaged in the work for a shorter time, and particularly those who exercise care in avoiding direct exposure to the active tube, show varying stages of oligonecrospermia. Several cases subject to infrequent exposures showed normal spermatic fluid. In none of these cases was there noted even a transient erythema of the scrotum, nor was there any deterioration of sexual activity. Of the married men none have begotten children since they undertook x-ray work.

Attention to this result of x-rays was first excited by Albers-Schoenberg, who exposed five male rabbits and six guinea-pigs, and made fourteen matings with unexposed females for periods of ten days to six months, without a single litter being produced, although the male covered the female as frequently as the normal animal does. Autopsy on these animals showed spermatozoa in the seminal follicles or testes in but one. These animals were observed for four and a half months after cessation of exposure, but failed to impregnate. Bergonie and Tribondeau reported similar results in white rats.

Halberstaedter concludes from his experiments that the ovaries are markedly more sensitive to the x-rays than the skin.

Philipp reports a case treated for pruritus ani, the time of total exposure being 195 minutes. Seven months later examination of the seminal fluid showed complete azoospermia. Philipp noted that after two exposures each for fifteen or twenty minutes for the cure of pruritus the number of spermatozoa was not diminished, but that they were all dead. This patient was so greatly relieved from his pruritus that he insisted upon two further treatments, after which the spermatozoa disappeared. Five months later the semen was found swarming with living spermatozoa.

The rays seem to produce a degeneration of the specific epithelial cells, though human spermatozoa in seminal fluid exposed for thirty minutes present no demonstrable change in form or motility. As a means of prevention it is suggested that the operator of the Roentgen tube should work behind a screen impermeable to the rays and should expose himself only when absolutely necessary, and then only for an extremely short time.

The *Therapeutic Gazette* says in commenting upon this: In view of the recent legislative activity in regard to the prevention of the breeding of idiots, hopeless epileptics, and criminals, if the sterilizing effect of the x-ray be permanent, this might prove a useful means of ridding communities of children cursed from their birth and destined to become a burden and expense to the state, and at the same time might make legislation directed to this end feasible by satisfying those whose objection is based upon the performance of a more or less mutilating surgical operation.

RADIUM.—Curie and Madame Curie have recently given to the scientific world (1902) a new element, radium, which is in an unstable condition, and constantly rediates energy. It yields an emanation which appears to be identical with helium gas. Radium, fortunately, only has been found in very small quantities, and is obtainable only in combination as salts of radium. It is so destructive to life that it can only be used in tubes containing ten-thousandths of a milligramme. Different tubes vary in physiological and therapeutic activity.

Action of Radium on Living Tissues.—Thies (Trans. *American Medicine,* August 26, 1905) found that this was much like that of the Roentgen

rays. He made a series of experiments, mainly on rabbits, with the following results: Tissues exposed very close to it for a long time were always killed, but those exposed at a distance were often stimulated to growth. *The most susceptible tissue was adenoid; second, skin and other epithelial tissues;* third, arteries and veins; and fourth, striped muscle. Elastic tissue and cartilage were much more resistant. The eosinophiles were often found in large numbers after exposure.

Dr. Darier, in a communication to the French Academy of Medicine, states that he has successfully employed radium in the treatment of certain forms of neuralgic and rheumatic complaints, the pain being removed by the action of radium on the nervous centers. A case of facial paralysis was quickly cured by two applications of radium in only slightly active form. Dr. Darier considers that the injurious effects on the nervous system at first observed were due to insufficient experience in the use of the new agent. Trachoma has been successfully treated by applications of a tube containing radium bromide. Care must be exercised in handling these tubes, as they occasionally explode, owing to greatly increased internal tension.

MUSIC.

Music belongs pre-eminently to the domain of psychological medicine. It is, therefore, appreciated to a greater degree by the neurologist and alienist than by the general practitioner. Man is something more than a definite combination of chemical compounds, and even more than a mere rational being; he is a moral and emotional individual, and this particular portion of his organization is the most innate and personal part of his nature as revealed to him by self-consciousness. When a man's feelings are touched, he is aware that he is profoundly moved, and that, whatever it may be in this structure which is affected, it lies deeper than his reasoning powers or his physical frame. When a man's sympathies are excited, he is impelled to a certain course of action by a more powerful force than that which he recognizes as emanating from his reasoning powers, or from what are ordinarily considered as the imperious demands of his bodily appetites. Happiness and misery, affection and aversion, love and hate find no place in natural philosophy or science, but they are powerful factors in human life, and in determining its issues for good or evil. Man is so constructed that his reasoning powers and emotions cannot be separated, nor can we think of these apart from their embodiment in a corporeal frame by which they are brought into material relationship and communication with the world. This being the case, the complete nature of man must come within the domain of medical science, which, indeed, finds expression in the old aphorism, "*mens sana in corpore sano*," health of the body not being complete without there is also mental health.

Physiological Effects. — Music, in addition to its influence upon the emotions, has a decided influence upon the body. M. J. Rambosson read a paper before the Académie des Sciences Morales et Politiques (July 18, 1877), entitled "The Influence of Music on the Physical and Moral Nature of Man." In this essay he affirmed that there is (1) music which acts specially on the intelligence and the motor nerves; (2) that which acts

specially upon the nerves of sensibility and on the sentiments; (3) that which acts simultaneously upon the motor nerves and on the sensory,—that is, on the intelligence and the sentiments. From experiments made by Dogiel upon men and the lower animals, the following deductions are drawn: (1) Music exhibits an influence upon the circulation of the blood. (2) The blood-pressure sometimes rises, sometimes falls. These variations in blood-pressure depend essentially on the influence of the excitation of the auditory nerve on the medulla oblongata, which is apparently in direct continuation with the auditory nerve. (3) The action of musical tones and pipes on animals and men expresses itself, for the most part, by increased frequency of the cardiac contractions, and hence it follows that the automatic centres of the heart act with greater energy. (4) The variations in the circulation, consequent on musical sounds, coincide with changes in the respiration, though they may also be observed quite independently of the respiration. (5) The variations in the blood-pressure are dependent upon the pitch and loudness of the sound and tone-color. (6) In these variations of the blood-pressure the idiosyncrasies of the individuals, whether man or the lower animals, are plainly apparent; and even the nationality, in the case of man, has some effect.[1]

Dr. Herbert Lilly, in the year 1880, wrote a pamphlet on the "Therapeutics of Music," in which he claimed that music directly influences the brain, in some individuals more than others, women being more readily affected than men. "Its effects are transmitted by a reflex action, through nerve-media, to the sympathetic system governing the vascular supply. The vessels are made to dilate by stimulation of the vaso-inhibitory nerves or paralysis of the vasomotor nerves, and so the blood flows freely and imparts that sense of warmth which is felt by us by reason of the local hyperæmia thus produced. By blood-supply is nutrition effected." The important influence upon the bodily functions of the imagination has already been referred to on a previous page. This, also, is under the influence, to a greater or less extent, of music.

The ancient habit of introducing music at banquets is based upon the well-attested fact that digestion is favored if the mind be pleasantly entertained during the time of eating. On the contrary, unpleasant thoughts or violent emotions will take away appetite and retard digestion. Children are usually fond of music, and their uninstructed attempts at dancing show the stimulating effects which it exerts on mind and body. In the adult life, when the musical taste is more cultivated, the feelings may be swayed by music "from grave to gay, from lively to severe." The sense of pleasure and elation of spirits from inspiring military music has been experienced by most of us; but when to these are added the charms of association as familiar airs are heard, the influence is deeper and more affecting. As an illustration, we may mention the effect produced by the unexpected hearing of patriotic airs when in a foreign land. Music may be instrumental or vocal, or both combined: "words to music fitly joined." Vocal music has in it a personal element far greater than instrumental, and the mother's songs to her fretful infant contain a subtle influence to soothe and comfort the child. In the same manner it is observed that in hospitals cheerful singing

[1] Letter to *British Medical Journal*, by Frederick K. Harford, of the St. Cecilia Guild. Nov. 14, 1891.

is very grateful, especially to those whose troubled minds increase their restlessness and physical suffering. Music diverts the mind from bodily pain and leads it into more pleasant channels.

Therapeutical Applications. — In dentistry, a pleasant application of music is that in which, during the administration of the anæsthetic gas, a music-box is made to play lively airs. This directs the patient's thoughts into an agreeable direction, and no apprehension beforehand is felt, nor is there any recollection of the tooth-pulling afterward, the patient on recovery being ready to affirm that he had been at the opera or a ball. A further use might well be made of this in practical surgery. In nervous hypochondriacs, people who are morbidly anxious about themselves, it is more effective to recommend the opera on one or two nights weekly—even opera-bouffe, if grand opera be not appreciated—than it is to prescribe ammoniated tincture of valerian, coca, or damiana. For depression of spirits or a tendency to melancholia, lively music, such as a concert by a military band, for those who enjoy it, and vocalization of tender or pathetic ballads for those of more sensitive nerves, are resources within the province of the skilled physician, who knows how to "minister to a mind diseased" even if he does not throw "physic to the dogs."

The State Pathological Institute of New York has recently investigated the question of the influence of certain musical tones and strains upon the nervous system, particularly in the case of the insane. By the aid of the ergograph, which is an instrument devised to note the amount of fatigue experienced by the muscles of the hand and arm used in psychological experiments, it has been found that when a lively air was played upon a harp more effort was put forth before fatigue was shown, while certain tones on the 'cello caused the opposite effect. This subject is an old one and is practically utilized in employing military bands to play enlivening airs during a march.[1]

A notable example of the influence of harmony in melancholia came within the personal experience of the author. Having charge upon one occasion of a gentleman afflicted with melancholia, the capitals of Europe were visited in search of every advantage of travel and recreation, but nothing touched the settled gloom of the patient until, in Vienna, we resorted to the grand opera. While listening mechanically to dulcet symphonies intertwined with the mellifluous notes of enrapturing cadenzas, following each other in rapid succession and harmonic progression, there appeared in the patient's face and demeanor the first manifestation of interest which had been noticeable for months. Subsequent visits not only confirmed the opinion first entertained, but continued and augmented the impression thus produced, until within a few weeks we had the satisfaction of witnessing a complete recovery.

In his famous "Anatomy of Melancholy" Burton gives an elaborate account of the medical qualities of music, telling us that "besides that excellent power it hath to expel many other diseases, it is a sovereign cure against despair and melancholy; will drive away the devil himself." Jaques Bonnet, in his "Histoire de la Musique et de ses Effets," tells how on one occasion he was entertained by a friend—then in the service of the Prince of Orange—with the performance of three first-rate musicians. This was

[1] *Philadelphia Medical Journal*, April 28, 1900, p. 934.

the remedy, he informed him, which his master employed to get rid of melancholy whenever therewith oppressed.[1] The chronic dyspeptic is very apt to be sad, morose, irritable, or hypochondriacal; such should be encouraged to resort to the concert and opera for entertainment and improvement. Those who have become weary from continued pursuit of an engrossing intellectual occupation may be most happily refreshed through the instrumentality of music.

In the case of many nervous children, it is a measure of the highest utility to give them a musical training as an outlet for their excitability and as a means of soothing perturbed consciousness. In case there is a tendency to narrow chest and insufficient vital capacity, the respiration may be made more full by having the patients learn to perform on wind instruments.

In Paris, musical performances are resorted to, with marked advantage, in hospitals, and some investigations have been undertaken in order to determine the influence of different kinds of music, especially in nervous cases. A St. Cecilia Guild has been formed in England, by Canon Harford. The objects, as set forth in the prospectus, are:—

"1. To test by trials, in a large number of cases of illness, the power of soft music to induce calmness of mind, to alleviate pain, and to cause sleep.

"2. To provide a large number of musicians, specially trained to sing and play the very soft music which alone should be administered to those whose nerves are weakened by illness. These musicians should be in readiness to answer promptly the summons of a physician.

"3. To hire or build, in a central part of London, a large hall, in which music shall be given throughout all hours of the day and night, this music to be conveyed by telephone attached to certain wards in each of the chief London hospitals.

"4. To obtain opinions and advice respecting the class of illness in which music is likely to be most beneficial, and to collect and record all reliable accounts respecting permanent benefit that has followed the use of music."

The work of sending musicians to hospitals and infirmaries has already commenced, and it is intended to continue the experiment long enough for a definite conclusion to be arrived at as to the services which music is likely to render to the sick. The scheme is said to have the warm approval of Miss Florence Nightingale and Sir Richard Quain and other eminent physicians.[2]

Professor Tarchanow, of St. Petersburg, in a recent lecture, takes the position that "music is of the greatest service in medicine," and that, by the proper use of it, the system can be tuned like a musical instrument. Sufferers from nerve disorders, especially epileptics, can, he states, be soothed by music, but the remedy must be employed with discretion. He attributes the frequent failure of music to its being used at the wrong time, or in unsuitable cases. He expresses the conviction that a time will come when music, "in the hands of scientifically-trained physicians," will be acknowled ed to be an agent of great power for the relief of suffering. That it will relieve insomnia and ease pain, not by any analgesic action on the

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1 London Letter to *Medical Progress*, Jan., 1892, p. 607.

2 Editorial Annotation, *British Medical Journal*, Sept. 12, 1891.

nerve-centres, but by distracting the sufferer's attention, will be admitted. The *British Medical Journal*, in commenting upon this, observes, editorially: "Here, we conceive, is the true field for music as a therapeutic agency, and it seems to us highly improbable that it can ever do more. . . . Within the limits which have been indicated, however, music may be a most useful handmaiden to medicine; and in this age of 'nerves' it might possibly be made to play an important part in the prevention of the many diseases which are fostered, if not actually engendered, by depression and fatigue."[1] Dr. Lilly, in the paper previously mentioned, states that there are two principal classes of cases in which music might prove a useful remedy: 1. Melancholic and depressed patients, dyspeptics, hypochondriacs, liver cases, parturient women, men suffering from business reverses or family affliction, —these require the tonic form of treatment. 2. Irritable, nervous patients; alcoholic subjects threatened with delirium tremens, overworked businessmen, persons suffering with hysteria or the mania of pubescence, pregnancy, parturition, the climacteric and chronic insanity, and such like,—these require music of a soothing character. The music itself must be well chosen, well executed, and scrupulously considered in relation to individual natures; otherwise, it is of no value therapeutically. In order to be effectual, it must be of the best quality, and devoid of impurities; it must be administered at regular intervals, and in suitable doses.

It should be observed that, in this country, weekly concerts and the frequent use of musical instruments constitute a part of the course of treatment pursued in all the asylums for the insane and feeble-minded patients, and the influence has been found to be favorable to recovery. Cases which are excited by the music that the others enjoy are kept away from the concerts, although they might be soothed by soft music.

E. N. Malioutine, of Moscow, states that the vibrations of the tuning-fork are transmitted from the vertex to the vocal cords and cause them to vibrate in unison. In this manner, and with vocal exercises, he cured a case of hysterical aphonia which had resisted all other methods, including suggestion. He thinks that the procedure might be found of value in training and improving the voice of singers.

The invention of the phonograph by Edison has greatly simplified the matter of giving music in regular doses and of the proper quality and variety. The use of sounds in Charcot's clinic, in order to produce high-note effects, has already been mentioned under "Hypnotism."

VARIOUS THERAPEUTIC METHODS MORE OR LESS MECHANICAL AND LOCAL IN THEIR EFFECTS.

Acupuncture.—The practice of inserting needles into the living tissues for the relief of pain or other disorder occupies a prominent place in Chinese medicine, and in some instances it is followed by strikingly beneficial effects.

The physiological effects of acupuncture are due principally to the reaction of the part against the traumatism; in other words, there is estab-

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[1] *Loc. cit.*, May 7, 1892.

lished a focus in which there is a dilatation and rupture of small vessels, hyperæmia, afflux of leucocytes, and increased nutritive energy due to stimulation of vasomotor and sensory nerves. This is accompanied by slight swelling, moderate increase of local temperature, and tenderness upon pressure. The passage of the needles through dense tissues also favors the escape or diffusion of incarcerated local effusions in the sheath of a nerve or around a joint. It is not impossible that the insertion of a metallic substance into the tissues may produce some alteration in the electric currents between the muscles, blood, and nerve-plates, and so interfere with the conduction of painful, afferent impulses along the sensory nerves.

Acupuncture is rarely resorted to at present, except in the modified form of the hollow needle connected with the hypodermic syringe. The hypodermic needle, indeed, is a very convenient agent for making acupuncture. Care should be taken that the needle is always perfectly aseptic. In **sciatica** a needle may be made to transfix the nerve as it passes over the bone at its exit through the sciatic foramen, or the point where pain and tenderness are most marked may be selected for the operation. In **lumbago** the introduction of needles into the affected muscles often affords marked relief in a few moments. This is more successful when the pain is bilateral than when only one side is affected, according to Ringer. Should the patient shrink from the punctures, the spot may be made insensitive by the local applications of ice and salt or by sprays of rhigolene or ether. Injections, under the skin or into the deeper structures, of morphine, atropine, cocaine, antipyrin, chloroform, or simply distilled water (aquapuncture) are often combined with acupuncture for the relief of neuralgia. In acute rheumatic affections acupuncture is useless unless in the combined form just mentioned.

In dropsy of the extremities, scrotum, etc., multiple acupuncture may be performed in order to relieve tension and encourage oozing. If the punctures are made with hollow needles they may be allowed to remain in place, as suggested by Spender, or fine perforated trocars, with drainage-tubes attached, may be used for the same purpose. Simple punctures close again very promptly, and we therefore must resort either to drainage-tubes or incisions. Exploring needles are convenient for making acupuncture, and useful in establishing a diagnosis. Baunscheidtism is multiple acupuncture, combined with counter-irritation. It will be discussed a few pages farther on.

The combination of electricity with acupuncture (electropuncture) suggests itself, and has been already considered under "Electricity." The difficulty with it is that, except for the electrolysis of surplus hair and for small growths in the skin, it is too painful. The electrodes are so small that the current is under too high a tension just around the poles. Macewen, of Dublin, recommends acupuncture in the treatment of aneurisms of large arteries, like the carotid or subclavian. A long steel needle is introduced into the interior of the vessel and the internal coat slightly roughened by scratching with the point, in this way favoring the production of a white clot and inducing the deposit of fibrin upon the interior of the aneurism, so as to thicken and strengthen its walls.

In the *Annals of Surgery* for January, 1891, Dr. Lewis S. Pilcher furnished an editorial review of Macewen's operation as described in an

address delivered before the Midland Medical Society.[1] The operation in question was designed for the cure of aneurism by inducing the formation of white thrombi within the sac. This object is secured by irritation at different times of the interior surface of the aneurism, this being done by a pin of sufficient length completely to transfix the aneurism and to permit manipulation within it. Its calibre should be as fine as possible, the strength being only sufficient to penetrate the coat of the artery and the intervening tissues. It is cylindrical, tapers to a point like an ordinary sewing-needle, and has on the opposite end a somewhat rounded head; as the coats of aneurisms vary in thickness, it is necessary for the pins to vary in calibre, since those which may pass readily through the walls of one sac may not penetrate the thicker walls of another. They should also be finely polished not only to facilitate their introduction, but to assist in rendering them aseptic. The object of the operation is to secure a white thrombus in an aneurismal sac, by irritating the wall of the aneurism in such a way as to induce infiltration of the parietes with leucocytes and a segregation of them from the blood-stream at the point of irritation. The irritation ought to be just sufficient to set up reparative exudation, and should not exceed it; if the irritation be pushed to such an extent as to induce softening of the vessel-wall, not only would the object be frustrated, but the pressure of blood from within might cause the aneurism to burst. It is sought to have several foci of irritation, in order to obtain which the inner surface of the aneurism is lightly scratched by the pin, which may be introduced through the wall at a convenient location, and the point then moved around in the interior of the sac so as to accomplish the desired result in the manner indicated.

It is considered desirable to secure as many points of irritation and thrombi-formation as possible, so that the resulting clot may be large enough to occlude the vessel. "The operation is preceded by careful cleansing and asepsis of the skin over the aneurism. The aseptic pin is then made to penetrate the sac and pass through its cavity until it comes in contact with the opposite side, and no farther. Then irritation may be effected, either by moving the pin over the surface of the inner wall or by allowing the impulse of the blood-current playing on the very thin pin to produce the same result.

"If the wall penetrated by the pin, on introduction, be dense, the former method will be preferable, as the force of the blood-current will produce so feeble an action on the thin pin as to be insufficient to move it to and fro while it is firmly grasped by the dense wall. After acting thus for ten minutes at one part, the point of the pin, without being removed from the sac, ought to be shifted to another spot, and so on until the greater portion of the internal surface opposite to the point of entrance has been acted upon." In some cases several punctures will be necessary in order to reach a sufficiently large surface of the inner wall. While the pin is in the aneurism, the protruding portion is surrounded by a bit of aseptic gauze, dry or moistened with an aseptic solution. When it is withdrawn from the aneurism, the part is covered with a moist antiseptic dress-

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[1] *British Medical Journal*, Nov. 15 and 22, 1890.

ing; for this purpose Dr. Macewen prefers a watery solution of carbolic acid, and he keeps this dressing in place for several days.[1]

Antiseptics are agents which prevent the development and check the activity of septic organisms. Inasmuch as these morbific agents are likely to find entrance by traumatism or by being brought into contact with a raw surface, the means of counteracting them is of great surgical interest, but has less to do with medicine proper. As it has been found, however, that the presence of bacilli and other forms of micro-organisms in the air-passages or intestinal tract or in the blood or the tissues gives rise to various diseases, such as diphtheria, typhoid fever, dysentery, diarrhœa, the exanthemata, measles, scarlet fever, erysipelas, etc., it becomes of medical importance to discover means of opposing them and of rendering them inert or, at least, of so reducing their virulence that they may do the least amount of harm. The problem is to find antiseptic agents which shall not be toxic to the human body, or so slightly toxic as to be perfectly manageable. Among these are alcohol, alphanaphthol and betanaphthol, formaldehyde, acetanilide, antipyrin, chlorates and chlorides, creosote, guaiacol, hydrogen dioxide, iodoform, iodol, creolin, naphthalin, quinine and other salts of cinchona, sozoiodolates of potassium and sodium, resorcin, salicylic acid and its salts, zinc phenolsulphonate, etc. For external use, carbolic acid properly diluted (1 to 20 or 1 to 40) and bichloride of mercury (1 to 500 or 1 to 2000), potassium-permanganate solutions, sozoiodolate of mercury or of zinc (2 to 5 per cent.) are very efficient. Arsenic and chloride of zinc are powerful antiseptics, but are too poisonous in their action upon the human body to be used, unless with extreme care. Formalin is a non-toxic, but efficient, bactericide. The use and application of the agents named will be found under appropriate headings in other parts of this work.

Aquapuncture has already been incidentally mentioned under the head of "Acupuncture." It consists in the use of a hollow needle to penetrate the tissues and the injection of pure water, recently boiled and sterile. It has been found from experience that this is often an efficient substitute for morphine injections, and that, in patients who have been unable to sleep without their evening hypodermic injection of morphine, the substitution of water has been made without detection by the subject of the experiment, and that sleep followed as usual. This is largely owed to the mental effect, which is very important to obtain in cases of insomnia as an aid to sleep. There is, however, a local effect of the puncture and injection of water into the tissues which is worthy of attention. In addition to the effects of acupuncture, which are not inconsiderable, there is a local tension caused by the fluid, which stimulates the absorbents to carry it away, and perhaps dissolves some morbific agent which causes pain or at least modifies the local chemical reaction.

Aquapuncture is used in the treatment of **neuralgia**, and, being entirely free from constitutional effects, it is better than morphine, antipyrin, and other agents commonly employed. There is no probability of the habit being formed, as with the use of these narcotic drugs; and, even if it should

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[1] From "Progress in Surgery in 1891," being the annual oration before the Academy of Surgery of Philadelphia, by Thomas G. Morton, M.D. Reprint from *Times and Register* of Philadelphia, Jan. 30, 1892.

be acquired, it will be harmless if care be taken to keep the needle and water perfectly aseptic.

Aspiration. — The pneumatic aspirator is an instrument invented by Dieulafoy for the removal of effusions or purulent collections by means of suction, or atmospheric pressure. The apparatus consists of a receiver, which, ordinarily, is a glass bottle of any desired capacity. Into this is inserted a cork having two perforations. Each perforation contains a metallic tube containing a stop-cock, and attached at the free extremity to a rubber tube. Finally, one rubber tube is armed with an aspirating needle, or trocar, and cannula; the other tube is attached to a small pump or exhaust-syringe. Now, the stop-cock attached to the needle being closed and the other one open, the syringe may be worked so as to exhaust the air in the receiver, when the stop-cock is closed and the partial vacuum maintained. If the needle be now inserted into any collection of fluid, and the appropriate stop-cock opened, the fluid will flow into the receiver until the supply is exhausted or the vacuum has been filled. The process can now be repeated, and this is done until the desired quantity of fluid has been removed. It may be necessary to empty the receiver several times during the operation. The great advantage of this method is that no contamination of the contents of the cavity by the air can take place; nor can air enter the wound of puncture, if it be promptly sealed with adhesive plaster. Several modifications of the apparatus are supplied. In one the syringe itself is made large enough to act as the exhaust chamber, and, by a double stop-cock, the fluid is drawn out by an upward movement of the piston, and by turning the cock it is discharged through a long rubber tube into a basin or other receptacle. Either form may be employed for injection by reversing the process, thus irrigating, or overdistending, the interior of an abscess, as practiced by the late Mr. Callender.

The ordinary hypodermic needle and syringe may be employed for aspirating small cavities or for purposes of diagnosis.

Capillary aspiration may be performed by attaching a long rubber tube to a hypodermic needle and filling it with antiseptic solution, leaving the extremity of the rubber tube beneath the surface of some water in a basin. The hollow needle is now introduced, by a rotary motion, through the tissues directly into the cavity, and retained in place by adhesive plasters. The flow of the liquid is much slower in this case; but this is an advantage in some cases,—for instance, in effusion into the pleura.

One of the dangers of aspiration of the chest is: the sudden alteration of pressure upon the walls of the blood-vessels by the rapid removal of the fluid might lead to congestion and, possibly, œdema. When the apparatus is not rendered aseptic, there is danger of exciting suppuration and septicæmia. Sudden removal of pleural effusions has been followed by death within a few hours, apparently of shock.

Pneumatic aspiration is a useful expedient for removal of dropsical effusions into serous cavities, serous exudations, or purulent collections in any accessible locality. Hydrothorax, ascites, hydrocele, hydropericardium, effusions into the pleuræ, pericardial sac, into the cavities of joints, are all easily treated in this way. Purulent deposits, such as in psoas abscess, hip-joint disease, which do not admit of open incision on account of danger of septic infection, are properly emptied by aspiration. Overdistension of the gall-bladder or urinary bladder may require aspiration, and if properly per-

formed the danger from peritonitis is inconsiderable. Large effusions of blood—hæmatocele, for instance—may be first injected with a pepsin solution to dissolve the fibrinous clot, and afterward exhausted with the aspirator. In pleural and pericardial serous effusions it is sometimes an advantage to perform capillary aspiration, when immediate relief is not required. The contents of ovarian cysts may be determined by examination of a portion withdrawn by aspiration. Hammond advises the introduction of a long aspirator needle into the liver in nervous hypochondriacs, in order to determine whether or not the symptoms may be due to abscess of the liver. In the condition of extreme tympanites, where the liver is displaced upward and the heart's action interfered with, the introduction of fine trocars or long hypodermic needles through the walls of the abdomen and intestine will permit the escape of the gas and afford great relief.

Bandaging.—In medical practice the ordinary surgical roller bandages are employed to make uniform pressure, in order to promote absorption of effused material; to support inflamed or swollen parts, such as a mammary gland or testicle; and to retain dressings, such as poultices or antiseptic appliances. Bandages may be made of any convenient dimensions, and are usually from two to three inches wide and from six to eight yards in length. They are ordinarily made from unbleached muslin free from sizing, but they also are made from thin white flannel, gauze, or crinoline. The flannel bandages not only may be applied to make pressure, but also are useful for their retention of warmth. In fact, in catarrhal inflammations of the throat, tonsillitis, laryngitis, etc., a flannel bandage around the neck is of considerable service. Inflamed rheumatic joints, either acute or chronic, are often materially relieved by a flannel bandage wound closely around the part. A flannel bandage from twelve to twenty-four inches wide, according to circumstances, worn around the waist, in infants, and even in older persons, is useful in preventing attacks of colic from exposure to cold.

In neuralgia accompanying neuritis, or in herpes zoster, a flannel bandage is an important part of the treatment. In acute pleurisy the application of a bandage around the chest prevents excursion of the ribs in coughing, and alleviates pain. It is sometimes useful to apply strips of adhesive plaster in the same way as in treating fracture of the ribs; this not only affords comfort, but keeps the effusion from becoming excessive in quantity. In chronic pleurisy the application of a bandage and the application of counter-irritants to the underlying surface considerably promote absorption. A bandage of narrow strips of adhesive plaster is applied to an enlarged testicle for the same purpose.

After delivery, the parturient woman is made comfortable by the application of a wide bandage extending from the hips well up on to the chest. This, in a measure, supplies pressure to the walls of the abdominal blood-vessels and prevents syncope. A bandage is sometimes applied during labor, previous to delivery, to support the uterus and abdominal walls.

Retentive bandages are required in various forms of hernia, and also in varicocele and in varicose veins. When the ankles tend to swell, bandages are applied with much relief and decided effect upon the œdema. A tight bandage around the head sometimes relieves headaches. In cases of apoplexy bandages may be wound around the thighs and arms in order to reduce arterial tension. When venesection is to be performed, a bandage is applied around the arm so as to cause the veins to become prominent. In cases of

snake-bite a narrow bandage should be thrown around the finger, or the limb, in order to prevent the introduction of the poison into the general circulation, except by degrees. In ordinary cases bandages should not be so close as to check the circulation in a limb, or gangrene may result. Retentive bandages are used to keep dressings and medicated compresses upon the surface of the body.

Brown-Séquard showed that the application of a tight bandage around the big toe would, in some cases, check or prevent an epileptic attack.

Baunscheidtism.—As already stated under the head of "Acupuncture," the procedure, named in honor of the German who invented the instrument employed in this manner of treatment, consists essentially in multiple punctures of the skin, into which some counter-irritant application is rubbed. The little instrument contains a spiral spring in a handle six or eight inches in length. At its inferior end the instrument is enlarged to form a circle from three to four centimetres (one to one and one-fourth inches) in diameter. In this crown are concealed eighteen or twenty needles, which are suddenly projected from a quarter to a half inch, when the spring is pulled up and suddenly released. If applied to the skin a circle of minute punctures is made by this procedure. Now, if croton-oil, diluted with sweet oil, be rubbed into these punctures, a decided inflammatory reaction is produced, affording considerable counter-irritant effect. This method is used principally for the treatment of chronic affections of joints attended with pains and more or less exudation. It also affords relief in myalgia, lumbago, and some forms of neuralgia.

Blood-letting and Transfusion.—Blood-letting is not entirely a lost art in medicine, but our therapeutical resources have so greatly increased within the past twenty or thirty years that its usefulness has been very much restricted.

General blood-letting is usually performed by opening a vein,—venesection, phlebotomy,—and the one selected is usually the median cephalic or median basilic, although it may be performed from any large superficial vein, such as the temporal, external jugular, or the veins on the dorsum of the hand or foot. Arteriotomy is sometimes done in cerebral affections, by section of the temporal arteries. In persons known as hæmophiles, or bleeders, any cut or rupture involving a blood-vessel is likely to produce hæmorrhage, followed by the effects of general blood-letting.

Although rarely resorted to at the present day, general blood-letting is a valuable therapeutical resource. It moderates high tension and vascular excitement, relieves congestion, allays nervous irritability and pain, and relaxes the muscular system. It also moderates inflammatory action and promotes absorption, and before the days of arterial sedatives was preeminently the leading antiphlogistic remedy. The history of medicine contains many instances of desperate cases where life was apparently saved by frequent resorts to the free use of the lancet. Albert Robin, of Paris,[1] says that blood-letting is distinctly indicated whenever it is necessary to stimulate the circulation of the blood, in cases of vascular stasis in mitral and asystolic patients, and in acute œdema of the lungs. It may even be asserted that blood-letting constitutes a valuable adjunct in a number of very dis-

[1] *Medical Press and Circular*, Feb. 9, 1898.

similar pathological conditions, provided they present the one element of defective nutrition, or, to be more exact, of inadequate organic oxidation.

The place that venesection occupies in therapeutics is an uncertain one. The late Dr. Hiram Corson strongly advocated bleeding for the relief of pneumonic patients, and said that, as there is always more or less attendant congestion, any time is the proper time to bleed. There are others, and these are the majority of clinical teachers, who advocate bleeding in pneumonia during the first stage, where there is a dilated right heart from obstruction in the pulmonary circulation. Finally, many others, of equally high authority, declare pneumonia to be a specific fever, incapable of being favorably influenced in its course or termination by abstraction of blood, which, on the contrary, may do much harm. In acute pneumonia, bleeding may be resorted to in order to reduce the toxinæmia and relieve the circulation; the need of it must be determined altogether by the circumstances of the individual case. Bleeding is undoubtedly serviceable in eclampsia, during pregnancy or parturition, or immediately afterward, provided there is high arterial tension as well as congestion of the brain. In convulsions following exposure to the sun, bleeding will relieve cerebral congestion; but it is highly injurious or fatal in the ordinary form of sunstroke. In narcotic poisoning and in uræmia, venesection is to be used with caution, but it is a justifiable resort in severe cases. Professor Ewald recommends bleeding in cases of uræmia to decrease the arterial tension and reduce the quantity of toxins. It is not to be used in all cases of uræmia, but only where the condition of the patient and his heart will permit. General blood-letting is of undoubted immediate service in some cases, also, where there is overdistension of the heart and vessels in extreme pulmonary congestion. It is of value in acute cerebral congestion accompanied by convulsions. In pulmonary emphysema, an occasional bleeding will afford prompt temporary relief and spare the patient much suffering in his last days. Dr. G. Newton Pitt has recently described nine cases of thoracic aneurism with or without aortic incompetence, in which venesection had been followed by considerable relief to the acute symptoms, as pain, cough, and dyspnœa.

In acute inflammations of strong, robust people, the judicious abstraction of blood often makes the patient more comfortable and lowers arterial tension. In iritis, a good bleeding is remarkably beneficial at the outset of the attack.

In patients of large, muscular frame when there has been a dislocation of a large joint, the abstraction of blood has been resorted to in order to produce complete muscular relaxation.

Blood-letting should be resorted to with caution in persons of feeble digestion and weak assimilative powers, and rarely, if ever, in elderly persons and very young children, in low fevers, in tubercular affections, and in persons disposed to hæmorrhage.

The local abstraction of blood is accomplished in a number of ways, the most common being scarifications, multiple punctures (the antiphlogistic touch of the late Prof. William H. Pancoast), and by leeches and wet cups.

Scarifications are linear incisions, superficial, for the most part, cutting into the derma or through granulating tissue, for the relief of local engorgement, as in conjunctivitis, granular lids, etc., and tonsillitis. In œdema of the larynx scarification is of great immediate relief; but in œdema of the

scrotum or lower extremities it is objectionable because the incisions do not heal readily. Multiple punctures may be skillfully performed with a fine knife, or tenotome, and congested blood-vessels relieved of their tension. It is absolutely required that the knife shall be surgically clean and recently made aseptic, or serious results may be produced. A felon may be aborted by early punctures through the soft parts to the bone.

A **leech** (hirudo) is an aquatic worm of simple annulated structure found in different parts of the world. Its mouth is armed with cutting teeth, with which it makes an incision through the skin and holds on by exerting a suction power; when it becomes filled with blood it drops off. It can be made to drop off earlier by application of salt water. The European or Swedish leech is about two inches in length, and will draw about half an ounce of blood. If the bleeding from the leech-bite be encouraged by warm fomentations, each leech can be estimated to cause the removal of one ounce of blood. The American leech is smaller, and will only take about one-fourth as much blood. If the discharge of blood from the leech-bites is more than is desired, it may be checked by touching them with a stick of nitrate of silver, a little Monsel's solution, or dry subsulphate of iron, by pressure, or by a small suture.

Cups may be **wet** or **dry.** The cup is a small, bell-shaped glass, which, at its upper extremity, has an opening guarded by a valve, so that, when applied to the surface, and the small syringe-pump employed to abstract the air, a partial vacuum will be formed and maintained in its interior. The soft tissues rise up into the cup and become deeply congested by dilatation of the blood-vessels. The spot may be scarified and the cup reapplied; so that when the air is exhausted the blood will flow in to take its place. This is called wet-cupping, and it is a valuable resource for local abstraction of blood and a revulsive agent. When the proper apparatus is not to be had, cups may be extemporized by egg-glasses or coffee-cups, the edges of which are thick and not likely to cut the skin. The air can be exhausted by pouring a few drops of ether or alcohol into the glass and igniting it; while the vapor is burning the cup is inverted upon the skin and the flame is immediately extinguished. The cup, in cooling, causes contraction of the air, and the tissues are forced into the cavity by atmospheric pressure. A piece of burning paper may be used in the same manner, to exhaust the air from the cup.

Local blood-letting reduces local hyperæmia and swelling, and, consequently, relieves pain; it limits the destructive effects of inflammation and favors restoration to the normal condition.

Cups and leeches are useful as revulsive agents and for local depletion. The latter are useful for inflammation of glands and swollen joints. In inflammation of the eye they are often resorted to. Cups are used in pneumonia, pleurisy, and other affections of internal organs.

Transfusion is the process by which there is introduced, directly into the blood-vessels of a patient, either blood or blood deprived of fibrin, milk, or various saline solutions. The transfusion of blood may be **immediate** or **mediate;** in using defibrinated blood or fluids other than blood, the process is always mediate. In the form known as immediate transfusion the vein of the patient is practically made a continuation of the vein of the donor of the blood by means of a short rubber tube. The method usually followed is to obtain a small rubber tube, having glass or silver tubes at its ends, and

with a bulb in its middle by which the blood can be urged forward on its course. It contains no valves; but when the bulb is compressed the operator must pinch the tube behind the bulb, and before the pressure is removed from the bulb the tube must be released and pinched in front of the bulb so that the suction shall be in the proper direction. This is known as the transfusion apparatus of Aveling. The method of using it is to obtain the assistance of a person who is in good condition and can spare from 240 to 360 c.cm. (or f℥viii-xij) of blood. The arms of both donor and receiver are properly prepared antiseptically. The median cephalic or basilic vein of each is then exposed by a short incision and the wall of the vein cut so that the cannula may be introduced, pointing toward the centre in the patient and toward the extremity in the donor. The little apparatus is filled with warm saline solution so that no air will enter the vein, and is put in place and confined there with a bandage, if necessary. Now, by proceeding as indicated, alternately slowly compressing the bulb and again allowing it to expand, the saline solution passes into the vein and is followed by blood. The entire amount of blood may be estimated by counting the compressions of the bulb, it having been determined previously by experiment how much blood is delivered at each movement. The operation is concluded by bringing the edges of the vein together with a fine suture and closing the wound and applying a light compress of gauze with a roller bandage.

Mediate transfusion is a less simple procedure. The blood to be injected is drawn into a bowl and whipped with some twigs in order to remove fibrin and prevent clotting. The defibrinated blood, carefully maintained at a temperature of 100° F., is drawn into a warm syringe and slowly injected through an opening in a vein, as in the preceding method. The most complete antiseptic precautions are required.

Arterial transfusion is rarely performed, although perfectly feasible, as shown by laboratory experiments. The objection is that it involves permanent obliteration of an artery on the part of the donor. A superficial artery, such as the dorsalis pedis, is selected, and, after dissection from overlying tissues, it is divided and a silver cannula inserted, connecting with a rubber tube with its opposite extremity armed with another cannula, which is introduced into a vein of the recipient. The force of the arterial circulation will make the blood traverse the tube, which should be kept warm with hot towels wrung out of bichloride solution.

Milk, on account of the presence of colon bacteria and other micro-organisms, produces a septic reaction when introduced into a vein, and its use for this purpose has now become obsolete. The same advantages may be obtained from saline solutions, introduced either with a syringe or aspirator. The following solution is recommended by Hayem as a sort of artificial blood-serum:—

℞ Sodium hydrate	1	Gm.	or gr. xvss.
Sodium chloride	5.30	Gm.	or gr. lxx.
Sodium sulphate	25	Gm.	or gr. cccxc.
Water, recently boiled and filtered	90	c.cm.	or f℥iij.

Of this from 1 to 4 pints may be slowly injected at a temperature of 100° F. It is important that, as recommended by Potain, the fluid be injected slowly, at a rate of 20 c.cm. (or f℥vss) per second. The specific gravity of the solution should be about 1.020.

Transfusion of blood has been practiced for years as the rational method of saving life where death is at hand from hæmorrhage. In post-partum hæmorrhage, or loss of blood attending abortion, this method has proved successful in many instances, as this is an emergency which finds the physician and attendants somewhat prepared. In other cases, as after surgical injury, where there is an element of shock, or after pulmonary hæmorrhage in tuberculosis, it has not been followed by a flattering degree of success. In intestinal hæmorrhage of typhoid fever it may be tried with a prospect of good results. The quantity of blood need not be more than from 120 to 240 c.cm. (or f℥iv-viij); it acts as a powerful vital stimulant to the heart, and is capable of tiding the patient over an emergency. In morbid states of the blood, transfusion has been performed, in a limited number of cases, without very encouraging results. In anæmia it has failed, but in the hæmorrhagic diathesis favorable reports are given by Dr. Joseph Buchser, of New York, though Dr. D. J. Brakenridge asserts that in pernicious anæmia transfusion exerts a beneficial influence, both on the blood of the patient and on the blood-forming organs, causing a disappearance of abnormally-formed blood-vessels and increasing the number of cells in excess of those supplied by the transfused blood. In carbonic-acid poisoning and phosphorus poisoning, transfusion has been used successfully. It has also been recommended in the treatment of toxic symptoms from unknown drugs, or where there are no known antidotes. In uræmic poisoning, it has been resorted to with satisfactory results.

Dr. A. Bier,[1] after a careful review of the symptoms produced when animal blood is injected into man, thought that alteration in the composition of the blood might possibly confer bactericidal power on it, and the sudden, intense, transient hyperæmia, the subsequent protracted, serous saturation of the internal organs and the skin, and the augmented metabolism and appetite, could not fail to benefit certain chronic, sluggish, infectious processes by giving them a general shake-up, as it were, and thus allowing the recuperative forces of the organisms a chance to work. Reasoning from these premises, Bier applied the transfusion of defibrinated *lambs'* blood as a therapeutic measure in eleven cases of advanced, incurable tubercular affections. The amount injected at a time ranged from 4 to 20 c.cm. (or f℥i-vss). The patients experienced transient flushing and swelling of the face, chills, pains, and fever. The appetite, which had been absent, returned after the first injection, and became ravenous in nearly every case. One case is reported in detail of a man with extensive open tuberculosis of the sacro-iliac symphysis on both sides. About twelve transfusions were given in four months, with disappearance of suppuration and almost closure of fistula. Four cases of lupus also showed remarkable retrogression of the lesions.

Dr. Hodder, of Montreal, used injection of warm sterilized milk in cases of **cholera** collapse, and Thomas, of New York, employed the same expedient successfully in **post-partum hæmorrhage.** Injections of normal salt solution, such as that of Hayem, have been very successfully performed in the stage of collapse in Asiatic cholera, or in cholera morbus. Professor Dawbarn, of New York, in similar cases, injects a hot (120° F.) saline solution into the femoral artery by means of a hypodermic needle and Davidson's

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[1] *Münchener medicinische Wochenschrift*, April 9, 1901; *Journal of the American Medical Association*, May 11, 1901.

syringe. The needle is inserted into the vessel by a slow, rotary movement and the end of the syringe is then tied over the base of the needle. About 473 c.cm. (or Oj) of the fluid is thrown into the artery at a time. The use of the blood of the lower animals is advocated by Gesellius and others, but is not to be recommended, on account of the difference in size of the blood-corpuscles and the danger of communicating infectious diseases or introducing parasitic organisms. The injection of blood into serous cavities, such as the peritoneum, has been recommended by Ponfick and indorsed by Bizzozero and Golgi, and has been successfully practiced.

Hypodermoclysis.—Instead of injecting normal salt solution, or artificial serum, into the veins as a substitute for blood-transfusion, the same result may be accomplished, when the solution is introduced into the areolar tissue by the process of **hypodermoclysis,** or subcutaneous injection by means of a hypodermic syringe or fine trocar and cannula. This procedure seems to have a beneficial influence in diphtheria by diminishing the liability to heart-failure. This procedure was practiced successfully by Loviot in the case of an infant extremely exhausted by gastro-enteritis. All other methods having proved ineffectual, artificial serum was injected subcutaneously into the thigh, abdomen, and forearm. The serum contained about 6 Gm. (or ʒiss) of table salt to 473 c.cm. (or Oj) of sterilized water. From 18.5 to 45 c.cm. (or fʒv-xij) were injected once or twice daily for a week.

Roget and Balvay report a case of diabetic coma with epileptiform convulsions relieved by the injection of large quantities of normal saline solution, 7 litres (or about Oxiv) being given within a period of five days, and three enemata of 525 c.cm. (or fʒxviiss) each being also administered. Recovery from the coma was complete, and the man lived for four months.

Dr. Robert Jardine,[1] of Glasgow, gives a tabulated report of 22 cases of puerperal eclampsia with 4 deaths. He attributed the small mortality (3 of the 4 fatal cases being first seen when in a moribund condition) to the use of saline solutions under the skin. Diuresis was established in a few hours, and the quantity of urine in some cases rose to 60 and even 100 ounces within the first twenty-four hours. An analysis of the urine before and after infusion showed a marked increase in the urea and uric acid after the infusion.

Normal salt solution is also used in typhoid fever with diminished secretion of urine, by rectal injections, 1 pint daily, until the quantity of urine secreted reaches the normal. Among the noteworthy effects are stimulation of the cardiovascular system, diminished tendency to complications, and when used early the nervous phenomena, such as insomnia, delirium, muscular weakness, are less than usual, owing to the removal of the toxins from the blood.

Intravenous injection of normal salt solution has been followed by success in puerperal eclampsia, and in the collapse of cholera. Dr. H. F. Hanks, of New York, approves very highly of the use of salt solution in the treatment of surgical shock, especially after severe hæmorrhage. In this condition nothing can take the place of intravenous injection of salt solution (115° F.), using from $^1/_2$ to 1 $^1/_2$ litres (or fʒxvii-li), as may be required by the condition of the patient. When the pulse-tension is restored, the injec-

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[1] *British Medical Journal*, May 26, 1900.

tion is stopped. He also resorts to it in septicæmia, and urges all surgeons to teach their assistants how to insert the injection-cannula, as no minor operation will ever bring better results than this operation when employed in the emergencies mentioned.

Dr. Eugene Boise has written in the *Medical News* for September 10, 1898, of the value of intravenous injection of the saline solution after surgical operations. With proper technique, he regards the intravenous route as safe as any other, while it is much more rapid in supplying fluid and heat to the system. In hæmorrhage succeeding intervention, in shock, sepsis, uræmia, and intestinal obstruction it is one of the most valuable therapeutical measures we possess.

Enteroclysis; Irrigation of the Bowels, Injections, Clysters, and Enemata.—Fluids or semifluid substances are injected into the bowel through the anal aperture in greater or less quantity, according to the extent of intestinal surface intended to be brought into contact with or to be affected by the medicament employed. The objects to be attained are the direct local effects upon the bowels, and the indirect or secondary effects, which are caused either by absorption of a portion of the enema into the blood or by an effect upon the nervous system or upon the temperature of the body. Enemata or injections are given (1) to cause prompt evacuations from the bowels; (2) to affect the thermal, chemical, or bacterial characters of the bowel contents, or act upon its mucous membrane; (3) to introduce certain substances into the circulation and produce systemic effects.

For making injections into the bowel a special instrument is employed, which was formerly called a clyster-pipe; it is now known by the general term of syringe. Various forms of syringes are offered to the profession. The simplest syringe is one with a cylindrical barrel containing a plunger and piston-rod, to which a ring or other conveniently-shaped handle is affixed, the opposite extremity terminating in a nozzle. The best syringes of this kind are made of hard rubber, which have almost entirely driven those of glass or pewter from the market. For an adult the syringe should have a capacity of from 120 to 240 c.cm. (or f℥iv-viij), which is usually sufficient for a simple enema, although larger quantities may be required. In childhood, from 30 to 120 c.cm. (or f℥i-iv) will prove sufficient, and in infancy from 15 to 30 c.cm. (or f℥ss-j) is ordinarily enough for an opening injection. Continuous-flow syringes are of two kinds: (1) gravity, or so-called fountain-syringe, and (2) bulb, or force- syringes. The fountain-syringe consists of a bag, with a capacity of a pint or more, connecting at the bottom with six feet or more of soft-rubber hose, to the end of which is affixed the usual anal, rectal, or vaginal tube. The bag, filled or partly filled with the fluid to be employed in the injection, is hung at the patient's bedside, from four to six feet above the level of the lower end, when introduced into the vagina or rectum; in this way the fluid gradually is introduced by hydrostatic pressure, without any other force being employed. The bulb syringes are of different shapes, but the principle is almost the same in all. A rubber-ball of cylindrical shape, with tapering ends, and of convenient size to grasp in the hands, is provided at each extremity with a valve, each opening in the same direction. A supply-tube passes from a receptacle of water, or the fluid to be employed in the injection, to one end of the bulb, and from the opposite end passes the delivery-tube, terminating in a nozzle of hard rubber. By alternately pressing and releasing the bulb, a current of fluid is sent along

the tubing with as much force as is desired. In fact, there is danger of using greater hydraulic pressure than was intended, and thus causing injury to the bowel, especially when weakened by disease or ulceration, such as occurs in dysentery or typhoid fever. One form of syringe makes use of air-pressure, instead of hydraulic pressure, the fluid being placed in a bottle connected with the delivery-tube and partly filled with the medicament desired to be thrown into the bowel. When air is pumped into the bottle, the liquid is forced out through the delivery-tube under less pressure than by the usual plan just described.

(*a*) Some formulæ for laxative enemata are as follows:—

Simple Laxative.

℞ Olei ricini vel olivæ..... 60| c.cm. or f℥ij.
Add to a half-litre (or f℥xvij) of soapy water, and use as an injection.

Stimulative.

℞ Olei terebinthinæ ..... 15| c.cm. or f℥ss.
Olei ricini ..... 45| c.cm. or f℥iss.
Add to a half or one litre (or f℥xvii-xxxiv) of hot soap-suds, and use as an enema.

Purgative.

℞ Tinct. aloes ..... 7|5 c.cm. or f℥ij.
Ol. olivæ ..... 60| c.cm. or f℥ij.
In a half-litre (or f℥xvij) of soapy water.

Evacuant.

℞ Glycerini ..... 1|2 c.cm. to 15| c.cm. or *m*xx-f℥iv.
Use as a rectal injection.

In cases of obstinate impaction a long tube should be inserted, so as to carry the glycerin into the vicinity of the mass and assist in breaking it up.

For Infants.

℞ Ol. olivæ opt. ..... 1̇5| c.cm. or f℥ss.
To be injected into the bowel to produce evacuation.

For Chronic Constipation.

℞ Sem. lini. ..... 15|5 Gm. or ℥ss.
Make an infusion with a half-litre (or f℥xvij) of boiling water, and, when cold, strain through muslin. Use each morning, as an enema.

(*b*) Injections administered for the purpose of affecting the thermal, chemical, or bacterial character of the contents of the bowel or to act upon its mucous membrane.

When comparatively large quantities of fluid are thrown into the bowel, the procedure is known as irrigation; and, when they pass the ileo-cæcal valve, as "**enteroclysis.**" Such large injections are not required for simple evacuation of the bowels, but are employed for various purposes connected with the state of the intestine or its contents. Thus, in states of fever, especially typhoid, large injections of cold water may be given, in order to remove the contents of the bowel, to reduce temperature, and for their effects upon the nervous system. In cholera, a form of irrigation is highly praised by Cantani, which is called **enteroclysis**, because by this means remedies are

carried, by an antiperistaltic motion, through the ileo-cæcal valve into the small intestine. Tannic acid being very destructive to cholera cultures, and, in the quantities employed, harmless to the human subject, was chosen as the principal agent to be used in the injection. Cantani's formula is:—

℞ Acid. tannic.	5 to 20	Gm.	or gr. lxxii-cccx.
Acaciæ pulv.	50	Gm.	or 3xiiss.
Vini opii	2	c.cm.	or f3ss.
Aquæ (temp. 100° to 104° F.)	2000	c.cm.	or Oivf3iv.

M. Sig.: To be used after each evacuation of the bowels.

Out of one hundred and seventeen cases of cholera treated by the above method, Lustig reported thirty-four deaths only, which is highly favorable as compared with other methods of treatment. The same plan has been used in cholera infantum and in summer, or sporadic, cholera, with excellent effects. In addition to these injections of tannin into the bowel, Cantani recommended **hypodermoclysis,** of a saline solution (3 per cent. sodium carbonate and 4 per cent. sodium chloride), at a temperature a little above that of the body (100.4° to 104° F.), into the subcutaneous connective tissue, by means of a Pravaz, or large hypodermic, syringe. In true cholera, during the algid state, the practice of hypodermoclysis is said to give startling results. Its object is to reduce the tendency to thickening of the blood following loss of watery fluids by transudation. Its advantages over intravenous injections consist not alone in avoidance of the danger of opening or manipulating veins, but also in the process of absorption being more uniform and natural. In one hundred and eighty-seven severe cases thus treated, the mortality was 39 per cent. Enteroclysis is used for the premonitory diarrhœa and the first stage, hypodermoclysis in the algid and typhoid stages; when the treatment is begun with the disease already advanced, both are used.[1] In some cases **"peritoneoclysis,"** or injection of saline fluid into the peritoneal sac, was cautiously practiced, without evil results, except slight tenderness and tympanites. Enteroclysis, or irrigation of the small bowel with warm water, is a valuable expedient in catarrhal jaundice and gall-stones. In the treatment of thread-worms, or oxyurides, large injections of salt-water or infusion of quassia, or of vinegar, are very efficient in dislodging these parasites from their headquarters in the cæcum and large bowel.

Astringent enemata are sometimes employed to check diarrhœa, and anodynes may be thus administered. For instance, laudanum (2 c.cm., or *m*xxx) in starch-water is very useful in relieving pain and tenesmus. Nitrate of silver (0.13 to 0.50 Gm., or gr. ii-viij, to 473 c.cm., or Oj, of warm water) is used in dysentery, especially if ulceration be present; it may be repeated once or twice daily. Carbolic acid, mercurial salts, and other agents which, if absorbed, would cause poisoning, should not be employed per enema. Very frequently diarrhœa is kept up by the presence of irritating substances in the intestine. Irrigation of the bowel has been found to be a resource of great value in such cases; and, even in infants, it has given highly-satisfactory results.

The mechanical effects of the distension of the bowel are chiefly utilized in the treatment of intussusception of the bowels; but they are also active

[1] "Annual of the Universal Medical Sciences," 1889, vol. i, D-32.

in every case in which the administration of an enema is followed by evacuation of the bowel contents. In some abdominal operations, it has been recommended to introduce a rubber bag into the rectum and distend it by the injection of water, so as to lift the organs in front of the bowel higher up in the pelvis, so that they may be more readily encountered by the suprapubic incision; the expedient just mentioned being of especial application in the case of stone in the bladder.

Dr. John R. Lichty says: "Water is a valuable aid in the treatment of the various forms of diarrhœa and dysentery. In dysentery, nothing can be used which will give more general satisfaction than enemas of plain cold water. They are grateful to the patient, do not produce nausea, and very largely relieve the tenesmus from the first. A noted physician has said of this treatment: 'It changes a huge internal into an external abscess, and enables us to cleanse the bowels of their putrid contents.'" J. Dewitt Graham praises the use of hot-water irrigation in the treatment of intestinal disorders in children, thoroughly flushing the bowel with a copious amount of hot water, using a long, soft-rubber tube that passes the internal sphincter, and provides an easy escape for the fæces. The irrigation is continued until the water comes away clear. This is repeated only as often as needed to unload the colon, to relieve tenesmus, or to induce rest. The author has used it with success in a child three days old.

(*c*) Injections into the bowel for the purpose of systemic effects are of two kinds: (1) medicinal; (2) nutritive. Medicinal enemata of tannin in cholera have been mentioned under the head of "Enteroclysis." In many instances remedies are administered in the form of a suppository of cacao-butter, which is fluid at the temperature of the body; but the same medicaments might be given in starch-water or other vehicle by enema. Quinine may be thus administered to children for malarial manifestations. Bromide of potassium and chloral are useful in reducing restlessness and tendency to convulsions in children; emulsion of asafetida is an excellent injection to be administered in a case of convulsions where there is supposed to be indigestible substances in the bowels acting as an irritant. Enemata containing alcoholic stimulants are sometimes administered. Although this method of administration of remedies is attended by some inconveniences, yet it is very useful where the stomach is irritable or the patient is unable to swallow drugs, as in coma, etc. It is capable of being extended in the case of children, who object to swallowing disagreeable medicine. In the treatment of phthisis, good results have been reported following the use of sulphureted waters by enema. The administration of nutritive material by injection into the bowel is of sufficient importance to be considered separately.

Rectal Alimentation and Intestinal Inhaustion.—It is a physiological fact that the absorbing surface of the large bowel may be utilized to support life when the stomach cannot digest food. Experience has shown, indeed, that life may be almost indefinitely sustained by the injection into the bowel of certain articles of food in a physical condition favorable for absorption. In gastric ulcer, for instance, it is necessary to allow the stomach time to heal without being called upon to digest food, not only because of the pain and vomiting following the taking of food and the danger of hæmorrhage, but also because cicatrization will proceed more rapidly, if uninterrupted. During this time, therefore, it is of great importance to introduce food by a channel which so fully answers the purpose and which is so closely allied

to the normal. The same proximate principles of the food can be introduced into the system when placed in the bowel as when they are taken into the stomach, the chief differences being that the food is not subjected to the same churning process in the bowel as in the stomach, and, of course, no gastric juice is furnished by the mucous coat of the large intestine. The capacity of the rectum is considerably less than that of the stomach. From this, we learn that nutritive enemata should consist of food in form most favorable for absorption and assimilation, and that the quantity should be comparatively small (about 120 to 180 c.cm., or f℥iv-vj), in order not to excite reflex contractions of the muscles by reflex action and rejection of the enema. It is desirable to set up a tolerance on the part of the bowel to the injections; and they should, at first, be given cautiously and a small quantity at a time, and repeated not oftener than at intervals of four hours. It may be necessary to reduce the sensitiveness of the mucous membrane by a preliminary injection of tincture of opium (2 c.cm., or *m*xxx) in starch-water, or an opium suppository may be introduced. In children, bromide of potassium and chloral may be substituted for the opium, or simple injections of cold water may suffice to render the bowel less intolerant. Cocaine is so uncertain in its action in different individuals that its use is not deemed advisable for this purpose.

The directions for preparing nutritious enemata are very simple. It is more convenient to have the substance in a fluid or semifluid condition and strained, so that it will pass through the syringe. Meat suppositories have also been used, but they are less efficient than enemata. The basis of the injection is usually milk, which should be scalded and partly peptonized. To this, meat-extracts, beef-juice, or beaten eggs may be added. If desired, a small quantity of brandy or whisky can be added also. The enema should not exceed 60 c.cm. (or f℥ij) at first, and the frequency of administration must be governed by the demands of the system and the tolerance of the bowel. If alimentation can be conducted in this manner every four hours and it is well borne by the patient, this interval should be maintained. In some patients, however, the interval may have to be prolonged to seven or eight hours, especially at the beginning. On a previous page of this work directions will be found for peptonizing different articles of food, some of which on account of the predigestion, might be used for rectal alimentation. The late Prof. Henry F. Campbell, of Augusta, Ga., called special attention to this method of supporting the powers of life by nutritious enemata, and he maintained, by introducing the food above the sigmoid flexure, that the liquid would be carried backward through the ileo-cæcal valve into the small intestine by a process of reverse peristalsis due to intestinal inhaustion. He showed that the system could be nourished perfectly and life sustained for many months by nutritive enemata. Milk injections containing the yelks of 1 or 2 eggs, with some powdered pancreatin or solution of pancreatin or papoid, will be found the most available and generally efficient. The juice of raw beef, or meat-extract, may be added to the enema after toleration has been established.

This method is to be used in gastritis, some cases of dyspepsia, gastric ulcer, carcinoma of the stomach, insufficient nutrition, persistent vomiting or pain after taking food, and in marasmus and other affections of young children. According to G. Singer, nutrient enemata given in gastric ulcer diminish the probability of recurrent hæmorrhage. This writer advises rec-

tal feeding in some cases of gastric dilatation and in excessive vomiting of pregnancy. In special conditions of disease it may also be resorted to with advantage; its utility in skin disease is sometimes very marked. (See a communication on "Rectal Alimentation and Medication in Diseases of the Skin," by the author: "Transactions of the Ninth International Medical Congress," vol. iv, pages 170 *et seq.*) For further discussion of the important subject of alimentation the reader is referred to the section upon "Diet in Disease" (page 1101).

Irrigation of the rectum with plain hot water is of decided service in chronic pelvic inflammations, with the exception of pyosalpinx. It relieves tympanites and is of advantage in the early stage of intestinal paralysis following sepsis. Rectal irrigation is of value in the treatment of hæmorrhoids. A jet of cold water from a bidet is especially recommended.

Setons and Issues.—These are expedients which had their origin in former ideas of pathology, and, consequently, at the present day, are nearly obsolete. Each depends upon setting up a point of irritation and suppuration on the surface of the body, in order to produce revulsive or counter-irritant effects upon deeper-seated pathological processes. A **seton** consists of a strand of cotton or silk, or other material, passed through a small fold of skin. A piece of silver wire or a strip of sheet-lead may be used. The thread may be carried through by means of a seton-needle, or the skin may first be perforated for the purpose with a bistoury. The seton is allowed to remain in position for several days or even weeks.

An **issue** is made by applying a cauterizing substance, such as caustic potassa, to a spot upon the skin, and, after the slough has separated, a dried pea, glass bead, or piece of orris-root is kept in place over the open surface by a bandage, so as to keep up irritation.

Setons in the neck (nucha) were formerly used in cases of obscure brain or spinal disease and eye inflammations. In infantile hydrocele of the cord a seton may be inserted for a few hours to set up adhesive inflammation. Issues and setons are now rarely employed, because of the danger of the wound becoming infected with erysipelatous, tuberculous, or other disease germs, and because continued suppuration may lead to septicæmia, Bright's disease, or lardaceous degeneration of kidneys and other organs.

Suspension in Disease of Spinal Cord, and Nerve-stretching in Nervous Disorders.—Among the mechanical means occasionally resorted to in medical practice is support of a portion of the body by suspension. Thus, in internal curvature of the spine, systematic exercise with suspension more or less complete, by instructing the patient to climb a ladder or a rope hand over hand, is a highly useful device for strengthening weak muscles and overcoming deformity. The same principle is applied in treating Pott's disease by Sayre's apparatus with a "jury mast."

A suspension-belt encircling the elbows so that the patient may sleep in a sitting posture, and a support afforded to the extrinsic respiratory muscles, forms an apparatus of great usefulness in asthma. About 1883, Motschutkowski, of Odessa, published reports of the relief afforded in cases of locomotor ataxia by suspension of the body from the shoulders. This method, it seems, was first applied by Prof. J. K. Mitchell, in Philadelphia, many years before. Motschutkowski and, subsequently, Charcot arrived at favorable conclusions from their experiments, and Prof. S. Weir Mitchell

has also published commendatory accounts of his experience with a form of apparatus of his own devising.

The effect of the treatment by the apparatus of Charcot or Weir Mitchell is to take pressure from the intervertebral cartilages and to straighten the curves of the spine. The good effects which have undoubtedly occurred in a number of cases may be due, as suggested by Dr. Julius Althaus, to the fact that spinal meningitis usually is found associated with pathological changes in the cord, especially in the posterior columns. Suspension produces a revulsive effect similar to that of cauterization and to passive motion of joints by which adhesions are stretched or broken and their absorption favored. Since suspension has given the most favorable results in old, advanced cases, it is very probable that this is true. There is no evidence that the spinal cord is stretched by this process; on the contrary, it may be relaxed. There have been some unfavorable results reported; but, considering the character of the cases, such accidents might be attributed to other causes, and certainly do not constitute a bar to the treatment when properly applied. Rosenbaum advises against suspension in pronounced cases of myelitis and in recent paralysis agitans.

The diseases in which suspension has proved beneficial, besides locomotor ataxia, are spastic spinal paralysis, amyotrophic lateral sclerosis, and neurasthenia, or functional nerve-prostration. S. Weir Mitchell is especially convinced of its utility in Pott's disease of the spine.

The number of papers published during the last two or three years, upon suspension in the treatment of nervous diseases, has been small, as compared with the large number appearing soon after Motschutkowski's early papers upon this subject. The same reports of improvement and disappearance, in part or entirely, of symptoms, have characterized recent communications. In a small proportion (in five out of twenty-five hundred cases of Rosenbaum) the improvement is remarkable. The lancinating pains are relieved, there is enhanced ability to walk, increase in appetite and bodily weight and in sleep. The gastric crisis, in a few cases, become less frequent, but paræsthesia of hands and feet and ocular symptoms are very obstinate.

Professor Leyden claims that the treatment of tabes by suspension produces no appreciable effect upon the pathological process; that neither on therapeutic nor upon scientific grounds is it reasonable to expect such a curative action, and that practical experience, when viewed with an unprejudiced eye, fails to show such effects; none of the results reported, he says, go beyond the effects of suggestion.

At Charcot's clinical service at La Salpêtrière, the form of suspension is by the chin and occiput, and the instrument employed is Motschutkowski's modification of Sayre's apparatus. Stillman[1] recommends the upright and recumbent curved board frames devised for orthopædic purposes.

Benuzzi has tried forcible flexion of the spine as a substitute for suspension, by forcibly flexing the body with the knees bent on the abdomen. A tabetic female treated in this manner showed material improvement. He experimented upon the cadaver and concluded that by this procedure the relation of the spinal cord to the spinal column is so changed that the cord is displaced upward three to four millimetres, and the vertebral column

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[1] *Weekly Medical Review*, St. Louis, Sept. 6, 1890.

lengthened from one and one-half to three centimetres, the increase in length being due to separation of the processes rather than of the vertebral bodies. The nerve-roots are displaced, but not noticeably shortened, with the exception of the **cauda equina**; there is lowered tension of the cerebro-spinal fluid. He regards the beneficial effects of suspension as due to traction upon the **cauda equina**, stretching it and, through it, the spinal cord; this, he thinks, is best accomplished by forcibly flexing the body with the knees upon the abdomen. Cagney, on the other hand, after extensive experiments upon both the dead and living body, denies that it is possible to stretch the spinal cord or nerve-roots by suspension; that, instead of extension of the spinal canal, there is a total shortening of it. He inferred that, if the cord is benefited by suspension, it is by relaxation, and not by stretching it.[1]

Nerve-stretching is an expedient for the treatment of various affections of the nerves attended by pain. As it involves a surgical operation,—the cutting down upon a nerve-trunk, isolating it, and subjecting it to more or less forcible stretching,—it need not be discussed here. It might be said, however, that in some cases of neuralgia (sciatica, etc.) this has been resorted to with marked relief to the patient, and that it is now an acknowledged surgical *dernier ressort* for such cases.

FORMULÆ FOR HYPODERMIC USE.

ALCOHOL.

℞ Spirit. frumenti ..... 15| c.cm. or f℥ss.
(Dose: 1.2 to 2 c.cm., or *m*xx-xxx.)

Or, ℞ Spirit. vini gallici ..... 15| c.cm. or f℥ss.
(Dose: 0.6 to 1.2 c.cm., or *m*x-xx.)

For syncope, hæmorrhage, heart-failure, shock, cholera, and snake-bites.

AMYL NITRITE.

℞ Amyl nitritis ..... 4| c.cm. or f℥j.
Alcoholis ..... 11| c.cm. or f℥iij.
M. (Dose: 0.6 to 1.2 c.cm., or *m*x-xx.)

For angina pectoris, chloroform narcosis, strychnine poisoning, and surgical shock.

APOCODEINE.

℞ Apocodeinæ hydrochloridi ..... |13 Gm. or gr. ij.
Sodii chloridi ..... |65 Gm. or gr. x.
Aquæ eucalypti ..... 15| c.cm. or f℥ss.
M. (Dose: 2 c.cm., or *m*xxx = 0.015 Gm., or gr. $^1/_4$.)

For chronic bronchitis, croup, whooping-cough, and hæmoptysis.

APOMORPHINE.

℞ Apomorphinæ hydrochloridi ..... |13 Gm. gr. ij.
Aquæ camphoræ ..... 6|1 c.cm. or *m*c.
M. (Dose: 0.12 to 0.5 c.cm., or *m*ii-viij = 0.0027 to 0.0108 Gm., or gr. $^1/_{25}$-$^1/_6$.)

For chronic bronchitis, bronchorrhœa, emphysema, hæmoptysis, chorea, whooping-cough, laryngismus stridulus, epilepsy, capillary bronchitis, and in narcotic poisoning.

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[1] "Annual of the Universal Medical Sciences," 1891, vol. ii, p. B-38.

AQUAPUNCTURE.

℞ Aquæ destillatæ ..... 60| c.cm. or f℥ij.

(Dose: 2 to 4 c.cm., or f℥ss-j.)

For neuralgia, myalgia, and paralysis.

ARSENIC.

℞ Liquoris potassii arsenatis,
Aquæ destillatæ ..... aa 7|5 c.cm. or f℥ij.

M. (Dose: 0.3 to 1.2 c.cm., or *m*v-xx.)

Or, ℞ Liquoris sodii arsenatis ..... 4| c.cm. or f℥j.

(Dose: 0.3 to 1.2 c.cm., or *m*v-xx.)

Or, ℞ Liquoris arseni et hydrargyri iodidi..... 7|5 c.cm. or f℥ij.

(Dose: 0.06 to 0.6 c.cm., or *m*i-x.)

For chorea, neuralgia, epilepsy, lymphadenoma, enlarged spleen, psoriasis, and chronic eczema.

ATROPINE.

℞ Atropinæ sulphatis ..... |008 Gm. or gr. $^1/_8$.
Aquæ destillatæ ..... 15| c.cm. or f℥ss.

M. (Dose: 2 c.cm., or *m*xxx = 0.00101 Gm., or gr. $^1/_{64}$.)

For sciatica, ovarian neuralgia, dysmenorrhœa, surgical shock, cholera collapse, pulmonary hæmorrhage, locomotor ataxia, mania, spasmodic asthma, seasickness, poisoning from aconite, muscarine, physostigmine or eserine, and opium.

CAFFEINE.

℞ Caffeinæ citratis ..... 1| Gm. or gr. xvj.
Aquæ destillatæ ..... 30| c.cm. or f℥j.

M. (Dose: 1 to 2 c.cm., or *m*xv-xxx = 0.032 to 0.065 Gm., or gr. ss-j.)

For neuralgia, hypochondriasis, asthma, organic heart disease, chronic Bright's disease, and uræmic coma.

CARBOLIC ACID.

℞ Phenol. liq. (puræ) ..... |25 Gm. or gr. iv.
Aquæ destillatæ ..... 15| c.cm. or f℥ss.

M. (Dose: 1 to 2 c.cm., or *m*xv-xxx = 0.015 to 0.032 Gm., or gr. $^1/_4$-ss.)

For erysipelas, phthisis pulmonalis, furunculosis, enlarged lymphatic glands, bubo, and neuralgia.

CASTOR-OIL.

℞ Olei ricini,
Olei amygdalæ dulcis ..... aa 30| c.cm. or f℥j.

M. (Dose: 4 to 15 c.cm., or f℥i-iv.)

Useful in obstinate constipation.

CHLORAL HYDRATE.

℞ Chlorali hydrati ..... 15|5 Gm. or ℥ss.
Aquæ destillatæ ..... 30| c.cm. or f℥j.

M. (Dose: 0.6 to 2 c.cm., or *m*x-xxx = 0.32 to 1 Gm., or gr. v-xv.)

CHLORAL HYDRATE AND MORPHINE.

Or. ℞ Chlorali hydrati..... 8| Gm. or ℥ij.
Morphinæ sulphatis ..... |13 Gm. or gr. ij.
Aquæ destillatæ ..... 30| c.cm. or f℥j.

M. (Dose: 2 c.cm., or *m*xxx = 0.5 Gm., or gr. viiss, chloral hydrate; 0.008 Gm., or gr. $^1/_8$, morphine sulphate.)

CHLORAL HYDRATE, MORPHINE, AND ATROPINE.

Or, ℞ Chlorali hydrati ..... 8| Gm. or 3ij.
Morphinæ sulphatis ..... |13 Gm. or gr. ij.
Atropinæ sulphatis ..... |008 Gm. or gr. $^1/_8$.
Aquæ destillatæ ..... 30| c.cm. or f℥j.

M. (Dose: 2 c.cm., or *m*xxx = 0.5 Gm., or gr. viiss, chloral hydrate; 0.008 Gm., or gr. $^1/_8$, morphine sulphate; 0.0005 Gm., or gr. $^1/_{128}$, atropine sulphate.)

For obstinate vomiting or hiccough, collapse from cholera Asiatica, cholera nostras, spasmodic asthma, mania, convulsions, and neuralgia.

CHLOROFORM.

℞ Chloroformi ..... 15| c.cm. or f℥ss.
(Dose: 0.3 to 1 c.cm., or *m*v-xv.)

Or, ℞ Spir. chloroformi ..... 15| c.cm. or f℥ss.
(Dose: 0.6 to 1.2 c.cm., or *m*x-xx.)

For sciatica, tic douloureux, and other neuralgias.

COCAINE.

℞ Cocainæ hydrochloridi ..... |50 Gm. or gr. viij.
Aquæ eucalypti ..... 30| c.cm. or f℥j.

M. (Dose: 2 c.cm., or *m*xxx = 0.032 Gm., or gr. ss.)

For producing local anæsthesia. Also in seasickness and vomiting of pregnancy.

CODEINE.

℞ Codeinæ phosphatis ..... |25 Gm. or gr. iv.
Aquæ destillatæ ..... 15| c.cm. or f℥ss.

M. (Dose: 2 c.cm., or *m*xxx = 0.032 Gm., or gr. ss.)

For neuralgia, hypochondria, delirium tremens, mania, and diabetes mellitus.

CODLIVER-OIL.

℞ Olei morrhuæ ..... 30| c.cm. or f℥j.
(Dose: 4 to 15 c.cm., or f3i-iv.)

For scrofuloderma, paræsthesia, ecthyma, pemphigus, lichen, etc.

CONIINE.

℞ Coniinæ,
Acidi acetici fort. ..... aa 11|83 c.cm. or f3iii*m*xij.
Aquæ chloroformi ..... q. s. ad 60| c.cm. or f℥ij.

M. (Dose: 0.06 c.cm., or *m*j, to begin with. 0.3 c.cm., or *m*v, contains 0.06 c.cm., or *m*j, of coniine.)

Or, ℞ Coniinæ hydrobromidi ..... |065 Gm. or gr. j.
Aquæ eucalypti ..... 15| c.cm. or f℥ss.

M. (Dose: 0.6 c.cm., or *m*x = 0.0013 Gm., or gr. $^1/_{48}$.)

For pleurisy, pneumonia, angina pectoris, emphysema, asthma, acute mania, and tetanus.

COTOINE.

℞ Cotoinæ ..... |5 Gm. or gr. viij.
Sodii bicarbonatis ..... 1|3 Gm. or gr. xx.
Aquæ destillatæ ..... 15| c.cm. or f℥ss.

M. (Dose: 0.6 to 2 c.cm., or *m*x-xxx = 0.021 to 0.065 Gm., or gr. $^1/_3$-j.)

For acute and chronic diarrhœa, diarrhœa of phthisis and typhoid fever. Also for night-sweats and Asiatic cholera.

CURARA.

℞ Curaræ ..... |065 Gm. or gr. j.
Aquæ destillatæ ..... 18|5 c.cm. or f3v.

M. (Dose: 2 c.cm., or *m*xxx = 0.0065 Gm., or gr. $^1/_{10}$.)

Or, ℞ Curarinæ sulphatis ..... |0032 Gm. or gr. $^1/_{20}$.
Aquæ destillatæ ..... 18|5 c.cm. or f℥ss.

M. (Dose: 2 c.cm., or *m*xxx = 0.00032 Gm., or gr. $^1/_{200}$.)

For tetanus, hydrophobia, chorea, and epilepsy.

DATURINE.

℞ Daturinæ ..... |0129 Gm. or gr. $^1/_8$.
Aquæ eucalypti ..... 30| c.cm. or f℥j.

M. (Dose: 0.6 to 1.2 c.cm., or *m*x-xx = 0.00027 to 0.00055 Gm., or gr. $^1/_{240}$-$^1/_{120}$.)

For neuralgia, asthma, epilepsy, and mania.

DIGITALIS.

℞ Tincturæ digitalis ..... 7|5 c.cm. or f℥ij.

(Dose: 0.3 to 1 c.cm., or *m*v-xv.)

Or, ℞ Tincturæ digitalis,
Spir. frumenti ..... aa 7|5 c.cm. or f℥ij.

M. (Dose: 0.6 to 2 c.cm., or *m*x-xxx.)

Or, ℞ Digitalini ..... |0129 Gm. or gr. $^1/_8$.
Spir. vini gallici,
Aquæ destillatæ ..... aa 7|5 c.cm. or f℥ij.

M. (Dose: 0.6 to 1.2 c.cm., or *m*x-xx = 0.00055 to 0.0011 Gm., or gr. $^1/_{120}$-$^1/_{60}$.)

For heart-failure, surgical shock, acute mania, hæmorrhage, and aconite poisoning.

DUBOISINE.

℞ Duboisinæ hydrochloridi ..... |0129 Gm. or gr. $^1/_8$.
Aquæ destillatæ ..... 30| c.cm. or f℥j.

M. (Dose: 0.6 to 1.2 c.cm., or *m*x-xx = 0.00027 to 0.00055 Gm., or gr. $^1/_{240}$-$^1/_{120}$.)

For asthma, locomotor ataxia, mania, sciatica, and dysmenorrhœa.

ERGOT.

℞ Fluidextracti ergotæ ..... 15| c.cm. or f℥ss.

(Dose: 1 to 2 c.cm., or *m*xv-xxx.)

Or, ℞ Ergotin. ..... 2|10 Gm. or gr. xxxij.
Phenolis liq. ..... |20 Gm. or gr. iij.
Aquæ destillatæ ..... 15| c.cm. or f℥ss.

M. (Dose: 0.5 to 1 c.cm., or *m*viiss-xv = 0.065 to 0.13 Gm., or gr. i-ij.)

For hæmoptysis, post-partum hæmorrhage, intestinal hæmorrhage of typhoid fever, purpura, uterine fibromata, varicose veins, varicocele, aneurism, enlarged spleen, enlarged prostate, leukæmia, and exophthalmic goitre.

ETHER.

℞ Ætheris ..... 15| c.cm. or f℥ss.

(Dose: 1.2 to 2 c.cm., or *m*xx-xxx.)

For heart-failure, surgical shock, syncope from hæmorrhage, snake-bites, typhoid pneumonia, variola, sciatica, biliary and renal colic, poisoning from aconite and veratrum viride.

GLONOIN (NITROGLYCERIN).

℞ Glycerylis nitratis ..... |065 Gm. or gr. j.
Spir. vini rectificati ..... 18|5 c.cm. or *m*ccc.

M. (Dose: 0.06 to 0.24 c.cm., or *m*i-iv.)

For angina pectoris, asthma, epilepsy, tetanus, chloroform narcosis, and strychnine poisoning.

HOMATROPINE.

℞ Homatropinæ hydrobromidi ..... | 0129 Gm. or gr. $^1/_5$.
Aquæ destillatæ ..... 30 | c.cm. or f℥j.

M. (Dose: 0.6 to 2 c.cm., or *m*x-xxx = 0.00027 to 0.0008 Gm., or gr. $^1/_{240}$-$^1/_{80}$.)

For night-sweats of phthisis, mania, and sciatica.

HYOSCINE.

℞ Hyoscinæ hydrobromidi ..... | 0129 Gm. or gr. $^1/_5$.
Aquæ destillatæ ..... 37 | c.cm. or f℥x.

M. (Dose: 2 c.cm., or *m*xxx = 0.00065 Gm., or gr. $^1/_{100}$.)

For chronic mania and dementia, insomnia, asthma, and sciatica.

HYOSCYAMINE.

℞ Hyoscyaminæ sulphatis ..... | 0129 Gm. or gr. $^1/_5$.
Aquæ eucalypti ..... 30 | c.cm. or f℥j.

M. (Dose: 1.2 to 2 c.cm., or *m*xx-xxx = 0.0005 to 0.0008 Gm., or gr. $^1/_{120}$-$^1/_{80}$.)

For acute and chronic mania, chronic dementia, epilepsy, paralysis agitans, and chorea.

MERCURY.

℞ Hydrarg. chlorid. corros. ..... | 065 Gm. or gr. j.
Aquæ destillatæ ..... 7 | 5 c.cm. or f℥ij.

M. (Dose: 0.6 c.cm., or *m*x = 0.005 Gm., or gr. $^1/_{12}$, once daily.)

Or, ℞ Hydrarg. chlorid. corros. ..... | 32 Gm. or gr. v.
Sodii chloridi ..... | 65 Gm. or gr. x.
Aquæ destillatæ ..... 30 | c.cm. or f℥j.

M. (Dose: 0.6 to 1.2 c.cm., or *m*x-xx = 0.006 to 0.0129 Gm., or gr. $^1/_{10}$-$^1/_5$, every second or third day.)

Or, ℞ Hydrarg. chlorid. corros. ..... | 32 Gm. or gr. v.
Glycerini ..... 4 | c.cm. or f℥j.
Aquæ destillatæ ..... 26 | c.cm. or f℥vij.

M. (Dose: 0.75 c.cm., or *m*xij = 0.008 Gm., or gr. $^1/_8$, every second day.)

Or, ℞ Hydrarg. chlorid. mitis ..... | 5 Gm. or gr. viij.
Olei olivæ ..... 15 | c.cm. or f℥ss.

M. (Dose: 1 to 2 c.cm., or *m*xv-xxx = 0.032 to 0.065 Gm., or gr. ss-j, twice weekly.)

Or, ℞ Hydrarg. chlorid. mitis ..... 1 | Gm. or gr. xvj.
Petrolati fl. ..... 15 | c.cm. or f℥ss.

M. (Dose: 1 to 2 c.cm., or *m*xv-xxx = 0.065 to 0.13 Gm., or gr. i-ij, twice weekly.)

Or, ℞ Hydrarg. formamid. ..... | 13 Gm. or gr. ij.
Aquæ destillatæ ..... 22 | c.cm. or f℥vj.

M. (Dose: 2 c.cm., or *m*xxx = 0.01 Gm., or gr. $^1/_6$.)

Or, ℞ Hydrargyri benzoatis ..... | 25 Gm. or gr. iv.
Sodii chloridi ..... | 032 Gm. or gr. ss.
Aquæ destillatæ ..... 45 | c.cm. or f℥iss.

M. (Dose: 1 c.cm., or *m*xv = 0.0054 Gm., or gr. $^1/_{12}$.)

MORPHINE.

℞ Morphinæ sulphatis ..... | 065 Gm. or gr. j.

Div. in chart. no. viij.

(Dose: One powder = 0.008 Gm., or gr. $^1/_8$, dissolved in 2 c.cm., or *m*xxx, of water.)

Or, ℞ Morphinæ sulphatis ..... | 13 Gm. or gr. ij.

Div. in chart. no. viij.

(Dose: One powder = 0.015 Gm., or gr. $^1/_4$, dissolved in 2 c.cm., or *m*xxx, of water.)

For neuralgia, uræmic convulsions, asthma, angina pectoris, colic, and cancer.

MORPHINE AND ATROPINE.

℞ Atropinæ sulphatis ..... |032 Gm. or gr. ss.
Morphinæ sulphatis ..... 1|3 Gm. or gr. xx.

M. et div. in chart. no. cxx.

(One powder = atropine sulphate, 0.00027 Gm., or gr. $^1/_{240}$; morphine sulphate, 0.01 Gm., or gr. $^1/_6$; to be dissolved in 2 c.cm., or *m*xxx, of water.)

Or, ℞ Atropinæ sulphatis ..... |015 Gm. or gr. $^1/_4$.
Morphinæ sulphatis ..... |38 Gm. or gr. vj.
Phenolis liq. ..... |32 Gm. or gr. v.
Aquæ eucalypti ..... 30| c.cm. or f℥j.

M. Dose: 0.6 c.cm., or *m*x = atropine sulphate, 0.00032 Gm., or gr. $^1/_{192}$; morphine sulphate, 0.008 Gm., or gr. $^1/_8$.)

For insomnia, asthma, hiccough, myalgia, colic, herpes zoster, sciatica, angina pectoris, cancer, and surgical shock.

MUSCARINE.

℞ Muscarinæ nitratis ..... |75 Gm. or gr. xij.
Aquæ destillatæ ..... 30| c.cm. or f℥j.

M. (Dose: 0.6 to 2 c.cm., or *m*x-xxx = 0.015 to 0.048 Gm., or gr. $^1/_4$-$^3/_4$.)

For night-sweats of phthisis and atropine poisoning.

NICOTINE.

℞ Nicotinæ ..... |03 c.cm. or *m*ss.
Mucilag. acaciæ,
Aquæ destillatæ ..... aa 4| c.cm. or f3j.

M. (Dose: 0.6 c.cm., or *m*x = 0.003 c.cm., or $m^1/_{20}$, of nicotine.)

For tetanus.

OSMIC ACID.

℞ Acidi osmici ..... |065 Gm. or gr. j.
Aquæ destillatæ ..... 18|5 c.cm. or f3v.

M. (Dose: 0.6 to 2 c.cm., or *m*x-xxx = 0.0022 to 0.0065 Gm., or gr. $^1/_{30}$-$^1/_{10}$.)

For sciatica.

PARACOTOINE.

℞ Paracotoini ..... 1|55 Gm. or gr. xxiv.
Glycerini,
Aquæ destillatæ ..... aa 7|5 c.cm. or f3ij.

M. (Dose: 0.6 to 2 c.cm., or *m*x-xxx = 0.065 to 0.20 Gm., or gr. i-iij.)

For intestinal tuberculosis and other forms of diarrhœa.

PELLETIERINE.

℞ Pelletierinæ sulphatis ..... 4| Gm. or 3j.
Aquæ destillatæ ..... 7|5 c.cm. or f3ij.

M. (Dose: 0.6 c.cm., or *m*x = 0.32 Gm., or gr. v.)

For paralysis, tetanus, and hydrophobia.

PHYSOSTIGMINE.

℞ Physostigminæ hydrochloridi ..... |065 Gm. or gr. j.
Aquæ destillatæ ..... 18|5 c.cm. or f3v.

M. (Dose: 0.6 to 2 c.cm., or *m*x-xxx = 0.0005 to 0.0016 Gm., or gr. $^1/_{120}$-$^1/_{40}$.)

Or, ℞ Physostigminæ salicylatis ..... |0129 Gm. or gr. $^1/_5$.
Aquæ destillatæ ..... 15| c.cm. or f℥ss.

M. (Dose: 0.6 to 2 c.cm., or *m*x-xxx = 0.0005 to 0.0016 Gm., or gr. $^1/_{120}$-$^1/_{40}$.)

Or, ℞ Extracti physostigmatis ..... |25 Gm. or gr. iv.
Aquæ destillatæ ..... 22| c.cm. or f℥vj.
M. (Dose: 2 c.cm., or *m*xxx = 0.021 Gm., or gr. $^1/_3$.)
For tetanus, hydrophobia, and strychnine poisoning.

PILOCARPINE.

℞ Pilocarpinæ hydrochloridi ..... |13 Gm. or gr. ij.
Div. in chart. no. xij.
(Dose: One or two powders = 0.011 to 0.021 Gm., or gr. $^1/_6$-$^1/_3$, dissolved in 2 c.cm., or *m*xxx, of distilled water.)
For hiccough, asthma, dropsy, uræmia, and chronic eczema.

Or, ℞ Pilocarpinæ nitratis ..... 1| Gm. or gr. xvj.
Aquæ eucalypti ..... 30| c.cm. or f℥j.
M. (Dose: 0.3 c.cm., or *m*v = 0.01 Gm., or gr. $^1/_6$.)

POTASSIUM IODIDE.

℞ Potassii iodidi ..... 15|5 Gm. or ℥ss.
Aquæ destillatæ ..... 30| c.cm. or f℥j.
M. (Dose: 0.6 to 2 c.cm., or *m*x-xxx = 0.32 to 1 Gm., or gr. v-xv.)
For syphilis, psoriasis, scrofula, lead poisoning, rheumatism, and gout.

QUININE.

℞ Quininæ sulphatis ..... 5|2 Gm. or ʒiv.
Acidi sulphurici dilut. ..... 9|25 c.cm. or f℥iiss.
Phenolis liq. ..... |13 Gm. or gr. ij.
Aquæ destillatæ ..... q. s. ad 15| c.cm. or f℥ss.
M. (Dose: 0.6 to 2 c.cm., or *m*x-xxx = 0.2 to 0.65 Gm., or gr. iii-x.)

Or, ℞ Quininæ hydrochloridi carbamidatæ ..... 8| Gm. or ℥ij.
Div. in chart. no. xxiv.
(Dose: One or two powders = 0.32 to 0.65 Gm., or gr. v-x, in 2 c.cm., or *m*xxx, of distilled water.)
For pernicious malarial fever, malarial cachexia, and sun-stroke.

SPARTEINE.

℞ Sparteinæ sulphatis ..... |13 Gm. or gr. ij.
Aquæ eucalypti ..... 15| c.cm. or f℥ss.
M. (Dose: 0.6 to 1.2 c.cm., or *m*x-xx = 0.005 to 0.01 Gm., or gr. $^1/_{12}$-$^1/_6$.)
For cardiac and renal dropsy.

STRYCHNINE.

℞ Strychninæ sulphatis ..... |065 Gm. or gr. j.
Aquæ eucalypti ..... 30| c.cm. or f℥j.
M. (Dose: 0.6 c.cm., or *m*x = 0.0013 Gm., or gr. $^1/_{48}$.)

Or, ℞ Strychninæ sulphatis ..... |021 Gm. or gr. $^1/_3$.
Phenolis liq. ..... |065 Gm. or gr. j.
Aquæ ..... 30| c.cm. or f℥j.
M. (Dose: 1 to 2 c.cm., or *m*xv-xxx = 0.00065 to 0.0013 Gm., or gr. $^1/_{96}$-$^1/_{48}$.)
For paralysis, progressive muscular atrophy, neuralgia, amaurosis, amblyopia, surgical shock, and aconite poisoning.

URETHAN.

℞ Æthylis carbamatis ..... 4| Gm. or ℥j.
Aquæ eucalypti ..... 30| c.cm. or f℥j.
M. (Dose: 4 c.cm., or f℥j = 0.5 Gm., or gr. viiss.)
For insomnia, tetanus, mania, and neuralgia.

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